City Council Report **Meeting Date: 2/7/17**

TO: **City Council**

FROM: **Bill Hack, Fire Chief**

RE: Standards of Response Coverage and Fire Department Staffing

REPORT IN BRIEF:
On November 1, 2016, the City Council voted to maintain a Fire Department minimum daily staffing of 17 line firefighters per day until March 7, 2017. The purpose of the extension was to allow the Council time to receive and review the Standards of Response Coverage Analysis and use that document as a basis for determining future staffing levels. This City Council report provides a historical perspective on Fire Department staffing levels, a summary of the recommendations made in and the alternatives provided within the Standards of Response Coverage, a list of potential staffing options including costs/benefits, and the recommendation of the Fire Chief.

Recommendations: The Fire Chief recommends approval of the following Options:

Option 1A – Acknowledge Receipt and Acceptance of the SOC

Acknowledge receipt and acceptance of the "Community Risk Assessment and Standards of Response Coverage Study – Final SOC" from Fitch and Associates. No recommendations or alternatives within the document will be legally binding.

Option 2A - Maintain Current Minimum Daily Staffing (17 Firefighters per day)

After comprehensive analysis, the Standards of Response Coverage concluded that given the prospective risk and historical demand for services specific to the City of Chico, 17 firefighters per day is an appropriate, efficient, and effective deployment model.

Estimated Funding Required: $352,150 for the remainder of FY 16-17, and $988,725 annually thereafter.

Option 3A – Direct Staff to Develop an Implementation Plan

Direct the Fire Chief to provide a recommendation on an optimized station location and deployment plan by November 1, 2017. This will allow adequate time to discuss and evaluate alternatives with internal and external stakeholders.

Direct the Dispatch Center to provide a Cost Analysis and proposed implementation plan for providing Prioritized Emergency Medical Dispatching. To ensure that an optimized system is in place and industry best practices are being utilized, it is also recommended that an efficiency analysis be completed.

FISCAL IMPACT:
The fiscal impacts vary based on the options selected. As such, the fiscal impact of any option will be provided when the item is discussed.

BACKGROUND:
In 2008, the City of Chico Fire Department maintained a minimum daily staffing level of 22 line personnel per day that operated 6 engine companies and 2 truck companies, with one of the engines cross-staffing 2 Aircraft Rescue Fire Fighting (ARFF) apparatus at the Chico Municipal Airport.

In 2013, the Department's operating budget was reduced, as the City faced tremendous financial challenges and all facets of the City were being impacted. As part of the reductions, the minimum daily staffing decreased from 22 to 16 line personnel per day. The Department staffed 4 engines, 1 truck, and an ARFF vehicle staffed with 1 person. One of the four engines was periodically down-staffed and one station was temporarily closed due to staffing/funding limitations.

Due to the impacts of the staffing reductions, the City was graciously awarded a Staffing for Adequate Fire and Emergency Response (SAFER) Grant from the Federal Government. SAFER was created to provide funding directly to fire departments to help them increase or maintain the number of trained, "front line" firefighters available in their communities. The goal of SAFER is to enhance local fire departments' abilities to comply with National Standards for staffing, response and operations. The grant process was complex, comprehensive and highly competitive. To qualify for the grant, the Department had to demonstrate the need for increased fire department staffing with quantitative data. The City also had to demonstrate how the increase in staffing would have direct, positive, and tangible benefits to the Chico community. The City received 5.289 million dollars that provided funding for 15 positions from May 2014-January 2017. At the time of award, this was the 7th largest grant in the nation. In the motion to accept the initial SAFER Grant, the Council also voted to reduce the Fire Department's "Salary and Employee Benefits" Budget (Overtime) by $600,000 per year for two years.

With grant funding, the Fire Department has maintained a minimum daily staffing of 17 firefighters and staffed a rapid-response Squad during peak service delivery times. This grant proved crucial to ensuring adequate fire and emergency response to the Chico community while the City restored fiscal health following the crippling budget cuts induced by the Great Recession.

The Fire Department utilized this time as an opportunity to re-examine how it provided fire protection to the Chico community. The grant provided the Department an opportunity to retool, re-evaluate, and change its response model. The mission was to develop an efficient, effective, realistic, attainable, and responsible model.

- Implemented a model based upon Comprehensive Community Risk Reduction. This was a significant and fundamental philosophical shift from a reactionary fire protection model to a proactive, forward-looking fire and disaster response service delivery model.
- Instituted a Fast-Attack Squad to strategically target and address excess service demand and risk.
- Formed and trained a 12-person Fire Investigation Team to proactively address the number of intentionally set fires in our community.
- Embraced a "Fire Based" Model and the concept of a Medical Priority Dispatch System (MPDS).

In late 2015, with the knowledge that SAFER Grant funding was temporary, the City hired an independent consultant to perform an efficiency analysis, specifically referred to as a Standards of Response Coverage (SOC). A SOC objectively evaluates the Fire Department's operations, deployment, and staffing. A SOC provides: (1) a comprehensive community risk analysis; (2) identifies areas where an excess or duplication of service exists and resources can be reallocated or eliminated; and (3) identifies emergency service and response gaps.

During the Budget Planning period for FY 16-17 the City applied for a second SAFER Grant. As of June 21, 2016, the date Council was scheduled to ratify the FY 16-17 Operating and Capital Budget, the City had yet to hear if the second SAFER Grant was approved or denied. After discussion by Council on whether to establish and fund a post-SAFER Fire Department staffing level, the City Council acted to approve the 2016-17 Operating and Capital Budget. City Administration assured the Council that there would be one-time funds available that could be allocated, if desired, to fully fund any of the proposed Fire Department staffing alternatives. On September 30, 2016, the City was denied a request for a second SAFER Grant.

On November 1, 2016, with the SAFER funding set to expire in January, the Council met to discuss post-SAFER staffing options. The Council voted to support the Fire Chief's recommendation to allocate the funds necessary to maintain a Fire Department minimum daily staffing level of 17 firefighters per day for two months. The two months of additional staffing was approved to provide Council adequate time to review the recommendations of the SOC and make a final data-driven decision on post-SAFER staffing levels. With SAFER, the Department funded 66 line personnel. On January 7, 2017, at the recommendation of the Fire Chief, the City laid off 5 personnel. One position was absorbed when Chief Hack's position was changed from interim to permanent. Sixty personnel is the optimum and efficient staffing level for maintaining a minimum daily staffing of 17 personnel.

Council, Management, Staff, and the public were provided the "DRAFT SOC Report" in late December 2016. The SOC was a comprehensive data-driven analysis predicated on the risks that are specific and unique to the City of Chico. The process evaluated risk from two broad perspectives: (1) a retrospective analysis of historical data – "demonstrated risk"; and (2) prospective analysis – "risk potential". The process provided the necessary framework to appropriately allocate personnel, apparatus, and fire stations that afford sufficient distribution and concentration of resources to mitigate the community risk. The document was also designed to provide information on alternative solutions to assist in the mitigation of risks.

The SOC provided several specific recommendations and alternatives:

- Recommended a minimum daily staffing of 17 line firefighters.
- Provided alternative options for station locations and recommended an "optimal" model.
- Recommended a deployment plan for the number and type of resources within the station model to meet the community risk and demand for services.
- Recommended the implementation of a Medical Priority Dispatching System (MPDS).

Council and staff were provided the opportunity to meet one-on-one with the Consultants and/or the Fire Chief to discuss the SOC in detail. The Fire Chief has held multiple stakeholder meetings to provide clarification on and receive input regarding the SOC.

DISCUSSION:

The Council is requested to make three separate decisions. It is Council's prerogative to select one of the options presented for each decision, or give Staff additional specific direction towards formulating other options. No action on the "Staffing Level" will result in the implementation of "Option 2C" on or around March 7, 2017.

1 - Acknowledge Receipt and Acceptance of Report

Option 1A – Acknowledge Receipt and Acceptance of SOC

Acknowledge receipt and acceptance of the "Community Risk Assessment and Standards of Response Coverage Study – Final SOC" from Fitch and Associates. No recommendations or alternatives within the document will be legally binding.

Option 1B – Return Report for Further Study
Acknowledge receipt of report, but return the document for further analysis.

2 - Staffing Level

Option 2A - Maintain Current Minimum Daily Staffing (17 Firefighters per day)
After comprehensive analysis, the Standards of Coverage concluded that given the prospective risk and historical demand for services specific to the City of Chico, 17 firefighters per day is an appropriate, efficient, and effective deployment model.

Estimated Funding Required: $352,150 for the remainder of FY 16-17, and $988,725 annually thereafter.

Option 2B – Return to Pre-SAFER Staffing (16 Firefighters per day)
Prior to accepting the SAFER Grant, the Fire Department's budget supported a minimum daily staffing of 16 firefighters per day. If Option 2B is selected, the Department would lay off a minimum of 3 additional personnel and close Fire Station 3 at the Chico Municipal Airport. This option would limit the Fire Chief's ability to evaluate and implement optimized station and deployment alternatives. This option should only be considered if the City can obtain an approved modification of the Airport Certification Manual or chooses to relinquish its airport certification.

Estimated Funding Required: $200,000 for the remainder of FY16-17, and $600,000 annually thereafter.

Option 2C – No Additional Funding (14 Firefighters per day)
In the motion to accept the initial SAFER Grant, the Council also voted to reduce the Fire Department's "Salary and Employee Benefits" Budget (Overtime) by $600,000 per year for two years. If the Council takes no action, it will result in Fire Department staffing dropping to a minimum daily staffing level of 14 firefighters per day. This is two firefighters per day less than the minimum daily staffing that was budgeted and allocated the day before the SAFER Grant was accepted.

Estimated Funding Required: With lay-offs of 9 firefighters, the City would have one-time payouts for accrued leave of approximately $30,000-$40,000.

3 – Implementation Plan

Option 3A – Direct Staff to Develop an Implementation Plan
Direct the Fire Chief to provide a recommendation on an optimized station location and deployment plan by November 1, 2017. This will allow adequate time to discuss and evaluate alternatives with internal and external stakeholders.

Direct the Dispatch Center to provide a Cost Analysis and proposed implementation plan for providing Prioritized Emergency Medical Dispatching. To ensure that an optimized system is in place and industry best practices are being utilized, it is also recommended that an efficiency analysis be completed.

Option 3B – Other
Provide modified or no direction regarding an implementation plan.

CONCLUSION:
As the Fire Chief has the responsibility to provide critical fire and emergency services, the Fire Chief is making the following recommendations to the City Council:

- Approve Option 1A – In the professional opinion of the Fire Chief, the report is comprehensive and complete.

- Approve Option 2A – This option would maintain a minimum daily staffing of 17 firefighters per day. This recommendation is supported by the independent and objective third party study of Fitch and Associates utilizing quantitative and temporal data analysis of the risk specific to the City of Chico.

- Approve Option 3A – Due to the complexity and sensitivity of several of the recommendations/alternatives presented in the SOC, it is both prudent and responsible to provide a detailed plan prior to implementation.

It is important to recognize that Staffing Option 2A, as recommended by the Fire Chief, does not reflect a return to pre-recession staffing or the prior status quo. This staffing model has 23% fewer firefighters on duty than prior to the recession. As emphasized and demonstrated in the SOC, this recommendation is not based upon National Standards, it is based upon the risk specific to the City of Chico. National Standards would dictate a minimum staffing of 32 firefighters per day operating from 8 fire stations; almost double the recommended option.

The Fire Department has made great strides in reducing the overall risk to the community and will continue to follow the Community Risk Reduction Model. The Department has been proactive in engaging with public safety partners and embracing technology to optimize and right-size response. A deployment model with 17 firefighters per day is an efficient, effective, responsible, realistic, and attainable model. Therefore, the minimum daily staffing of 17 firefighters per day is the lowest staffing level that the Fire Chief can support.

Prepared by:

William R. Hack, Fire Chief

Approved by:

Mark Orme

Mark Orme, City Manager

DISTRIBUTION:
City Clerk

ATTACHMENTS:
Exhibit A – Executive Summary, Fire Department Standards of Coverage Analysis, January 25, 2017.
Exhibit B – Fire Department Standards of Coverage Analysis, January 25, 2017.

EXECUTIVE SUMMARY

In late 2015, the City of Chico contracted with Fitch & Associates to objectively evaluate the fire department's operations, deployment, and staffing. The City and Department were largely motivated by the uncertainty associated with the maturation of the SAFER grant and the desire to develop a risk-based data driven staffing and deployment plan based upon the specific and unique profile in the City of Chico. These analyses culminated in a comprehensive deployment and staffing plan referred to as a Standards of Response Coverage (SOC).

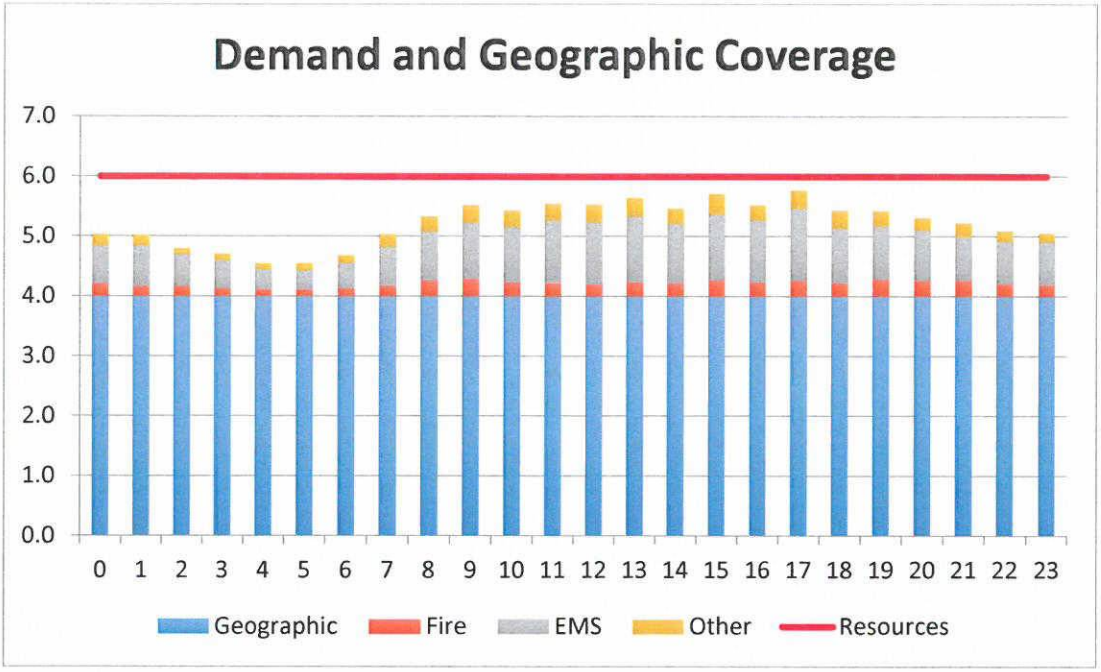
Comprehensive data based quantitative and geospatial analyses were utilized to objectively evaluate the historical community demand for services by type and severity. Occupancy level data were obtained from the Insurance Services Office (ISO) and the California State University – Chico and was utilized to assess occupancy level risk within the community. Ultimately, the risk assessment identified two high-risk station areas in Stations 1 and 2 and the remaining stations were ranked as moderate with the exception of Station 3 that was categorized as low.

The current travel time performance is six minutes or faster at the 90th percentile. Geospatial analyses suggested that the City could maintain current performance with a minimum of four stations providing the City opportunity to reduce future capital expenditures. To realize this model, the Department would have to either occupy or build a station near the immediate vicinity of the County's Station 42.

The distribution of risk and demand within the City of Chico is primarily focused in and around Stations 1 and 2. Results indicate that this concentration of risks would be better served by a higher concentration of resources nearest to the risk, which is accomplished by the recommended four-station deployment model.

It is recommended that the City staff a minimum of 17 personnel per day (shift). This recommendation is a culmination of triangulated data elements. First, the relationship between distribution of resources (stations) and the concentration of resources (units or personnel) is best served by a higher concentration of resources (two units each) in the high-risk station areas 1 and 2. In other words, this configuration would place the greatest firefighting capacity in the areas that have both the greatest measured risk and the most frequent demand for all-hazard services.

Second, the average demand for services requires two units per hour for the peak of the day. In order to maintain the recommended and current travel time performance, then the most efficient model is a four-station model requiring four geographic units. The combination of geographic units and the average demand for services necessitates a six-unit deployment model to maintain both the geographic and demand coverage in order for the system to perform as designed. A graphic representation is provided below.



Third, is the combined consideration of both the incumbent risk in the community that includes limited protection from automatic sprinkler systems and off-campus multiple occupancy student housing, and the realization that the City lacks a robust and timely automatic aid capacity. The lack of available capacity that similarly situated cities in a metropolitan area may enjoy, creates a greater necessity for the City of Chico to maintain sufficient autonomous resources to assemble an effective response force. The average demand of two resources, and five to six personnel, per hour for the majority of the day would essentially neutralize the County's immediate contribution. The automatic aid agreement between the City and the County are essential and efficiently maximizes the available resources.

Other priority recommendations include the consideration of implementing a medical call triaging system such as the Medical Priority Dispatch System (MPDS) in the communications center so that calls can be prioritized and better match resource to risk. The technology assistance will allow the City to cost avoid future investments as the community's demand for services continue to increase by redistributing low-acuity calls or responding in a more cost effective manner.

Finally, the City is encouraged to shift to a proactive fire prevention model that reduces community risk. A long-term solution is to better mitigate risk through prevention efforts, such as automatic sprinklers, that will ultimately reduce the resource demand for the department and more effectively mitigate community risk with a much higher return on investment.

January 2017

Community Risk Assessment and Standards of Response Coverage Study

SOC Report

Chico Fire Department
Chico, California

Prepared by:

FITCH & ASSOCIATES, LLC
2901 Williamsburg Terrace #G ▪ Platte City ▪ Missouri ▪ 64079
816.431.2600 ▪ www.fitchassoc.com

CONSULTANT REPORT

COMMUNITY RISK ASSESSMENT AND STANDARDS OF COVER
CHICO FIRE DEPARTMENT, CHICO, CA

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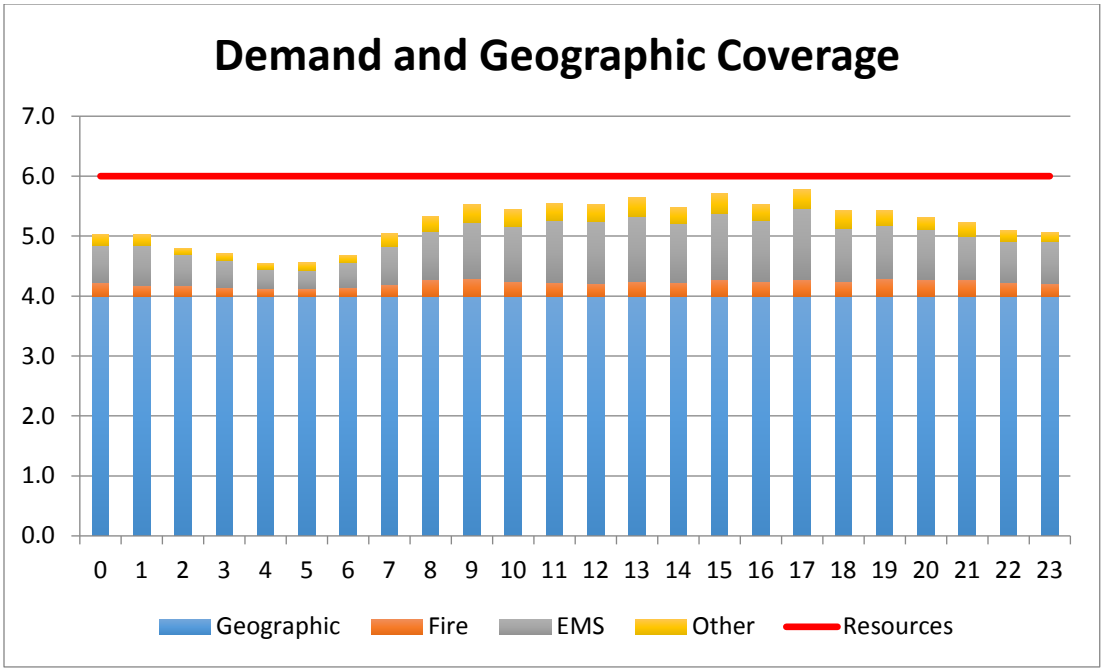

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DESCRIPTION OF COMMUNITY SERVED

Introduction

The Chico Fire Department (CFD) is a full-service fire agency providing fire suppression, aircraft rescue and firefighting (ARFF), fire prevention, technical rescue, hazardous materials mitigation, as well as first responder basic life support (BLS) with Automatic External Defibrillator and advanced life support services (ALS) for specialized teams including technical rescue, hazardous materials and Chico Police SWAT teams. Butte County EMS provides ALS pre-hospital care and transportation to the community under a joint venture between Enloe Medical Center and First Responder Emergency Medical Services.

The City of Chico (Chico) is located in the Northern Sacramento Valley of California, 90 miles north of Sacramento, in Butte County. Chico is the most populous city in Butte County, with an estimated population of 89,180 at the 2015 census estimate. The City's service area is 33 square miles, and is characterized by an urban and suburban community mix. The city is a cultural and commercial center for a three-county regional market area. Chico supports a diverse range of industries including agriculture, recreation, tourism, medical, manufacturing and education. California State University, Chico is the second oldest institution in the California State University system, enrolling over 16,000 students. Bidwell Park, the Country's 26th largest municipal park and the 13th largest municipally owned park makes up over 17% of the City. Enloe Medical Center is located in Chico and serves as the regional medical hospital and Level II Trauma Center.

Butte County is made up of the Chico Metropolitan Statistical Area. The County Seat is located in Oroville. Known as the "Land of Natural Wealth and Beauty", Butte County is watered by the Feather River and the Sacramento River. Butte Creek and Big Chico Creek are additional perennial streams, both tributary to the Sacramento. Butte County has a total area of 1,677 square miles and a 2015 estimated population of 225,000. Part of the County's western border is formed by the Sacramento River. The County lies along the western slope of the Sierra Nevada, the steep slopes making it prime terrain for wildland fires and the siting of hydroelectric power plants. In addition to California State University, Chico, the County is also home of Butte College, a large junior college.

The CFD serves a total population of approximately 89,180[1] within a geographic area of approximately 33 square miles. Unincorporated areas within the service area bring the population estimate to approximately 100,000. Service is provided from six (6) fire stations with a force of 66 firefighters and three (3) division chiefs. The CFD maintains a robust automatic aid agreement with the Cal Fire-Butte County Fire Department

Administrative staff consists of one (1) fire chief, one (1) fire marshal, one (1) fire prevention specialist and one (1) fire inspectors, two (2) administrative analysts. Additional volunteers from

[1] Accessed online at http://www.census.gov/quickfacts/table/PST045215/0613014

Company 1 who support larger scale emergencies such as confirmed structure fires, aircraft crashes or train wrecks, and major rescues. The Fire Chief is the Chief Executive Officer of the Department and reports to a City Manager who is appointed by a seven (7) member City Council.

Legal Basis

Chico was founded in 1860 by General John Bidwell, and incorporated on February 5, 1872. The Department was legally formed on April 5, 1873.

Chico is a Charter City with a Council Manager form of government. As a Charter City under the State of California Government Code Section 34101, the voters in the City are given broad local control to determine how their City Government is organized, the authority to establish services to benefit the community and, with respect to municipal affairs, enact legislation different than that adopted by the State. The CFD is in compliance with the State of California Government Code Section 38600-38611 which outlines the regulations applicable to City Fire Departments, their formation, powers, and authority. The CFD is also allowed to provide emergency medical services (EMS) under the California Health and Safety Code 1797.201-1797.227 under the authority of the Local Emergency Medical Services Agency (LEMSA).

The Fire Chief is the Chief Executive Officer of the Department and is appointed by the City Manager.

History of the Agency[2]

The Chico Board of Trustees called a meeting on March 17, 1873, for the purpose of organizing fire protection, and on April 5, 1873, Company No. 1 was formed. The records of that meeting list 44 names of prominent businessmen, clerks, and mechanics making up the official roster. The largest fire to strike Chico occurred two weeks later, on April 19, 1873, when a fire began at a stable at Third and Main. Fanned by winds, the fire destroyed building after building along the west side of Main Street to Broadway until it was stopped at First and Main. 38 horses died in the blaze.

In 1887, the California legislature established what would eventually become California State University, Chico. In 1905, Annie Bidwell donated 1,903 acres to the people of Chico for a public park, resulting in the creation of Bidwell Park.[3] During World War II, what is now the Chico Municipal Airport was used to train fighter and bomber pilots. As the area continued to develop, the Department sought the need to build additional fire stations in response to the growing needs of the community.

The CFD has met the many challenges faced with rapid growth; specifically, the transformation from a traditional volunteer department to a combination volunteer-career department, the introduction

[2]Chico: Life and Times of a City of Fortune by Debra Moon, Arcadia Publishing
[3] History of Chico accessed online at: https://en.wikipedia.org/wiki/History_of_Chico,_California

of emergency medical services, fire prevention services, hazardous materials response, increased federal and State training requirements, as well as many other challenges. Despite this, the Department has developed along with the community it serves.

Today, the population is estimated to be 89,180. The CFD operates six fire stations and is authorized for 74 personnel including firefighter/EMTs, administrative staff and chief officers. 15 of the authorized personnel are funded by the Federal Emergency Management Agency (FEMA), Staffing for Adequate Fire and Emergency Response (SAFER) Grants program. The SAFER program was created to provide funding directly to fire departments to help them increase or maintain the number of trained "front line" firefighters available in their communities. The goal of SAFER is to enhance the local fire departments' abilities to comply with staffing, response and operational standards established by the NFPA.

Financial Basis[4]

Overview

Chico receives the majority of its general fund revenue, 73% in fiscal year 2015, from sales and use taxes as well as property taxes. These two revenue sources were negatively impacted by the recession with significant reductions from fiscal year 2009 to 2013.

Chico's local economy continues to rebound from the economic recession. Since the end of the recession, economic growth has been measured but steady. The following major revenue sources increased:

- Sales Tax increased 5%
- Property tax revenue increased by 11%
- Transient Occupancy Tax increased 6%

Sales tax revenue, which accounts for 43% of all General Fund revenue experienced moderate growth. Property tax revenue grew due to construction of new homes and modest growth in the resale of existing homes. Residual property tax revenue, a relatively new source, came into place following the dissolution of the City's Redevelopment Agency. As the former Redevelopment Agency's commitments are liquidated, the City receives a larger share of this property tax source.

Although the General Fund's total fund balance is positive, the Fund does not have an Operating Reserve or Emergency Reserve. Thus, the City will continue to stay focused on maintaining a long-term focus that approaches additional spending in a way that is fiscally sustainable. City's fiscal policies have been developed to ensure City Funds do not fall into a deficit position; that new revenue sources, one-time revenue sources and annual cost savings are prioritized to reduce current

[4] City of Chico Comprehensive Annual Financial Report, Year Ended June 30, 2015

deficits and build reserves; implementation of tighter spending controls; and a significant shift of budgetary and spending control from the City Manager to the City Council.

City management will continue to present the Council with conservative budgets, recommendations to increase reserve fund balances, budgets that provide consideration of City cash flows, and as identified, additional fiscal controls that will ensure the City continues to rebound from the precarious financial position that has existed in recent years. City staff will continue to operate in the face of reduced resources, while seeking out innovations and deployment optimizations. The City believes it will be in a better position to respond to future economic downturns that have negatively impacted the City's finances. The challenge for City management is to continue to identify opportunities to cut costs, create efficiencies and provide excellent service to the community.[5]

In fiscal year 2013, the CFD applied for and was awarded a multi-year $5.3 million Federal Emergency Management Agency (FEMA) Staffing for Adequate Fire and Emergency Response (SAFER) Grant. This allowed the CFD to hire 15 full time firefighters. In fiscal year 2015, public safety expense increased $2,109,794 mainly due to expenditures associated with the Staffing for Adequate Fire and Emergency Response Grants (SAFER) utilized by the fire department. The SAFER Grant was set to expire in April 2016, but FEMA extended the funding until January 2017. The Department has requested and the Council approved another SAFER Grant application, but the City was not awarded the grant for 2017. If FEMA does not renew the SAFER Grant, there are one-time reserve funds that could be transferred to cover fiscal year 2016. The City currently does not have allocated funds to cover the 15 grant-funded positions beyond fiscal year 2016.[6]

So while some economic progress is expected over the next two years, the significant question is whether or not the level of economic growth is sufficient to provide the revenue necessary to meet increasing City and Department costs.

Even in light of the economic challenges the CFD has been responsible with their funding, evident by successful independent audits of the City and Certificate of Achievement for Financial Reporting by the Government Finance Officers Association for transparency and reporting.

Expenditure Controls and Restrictions

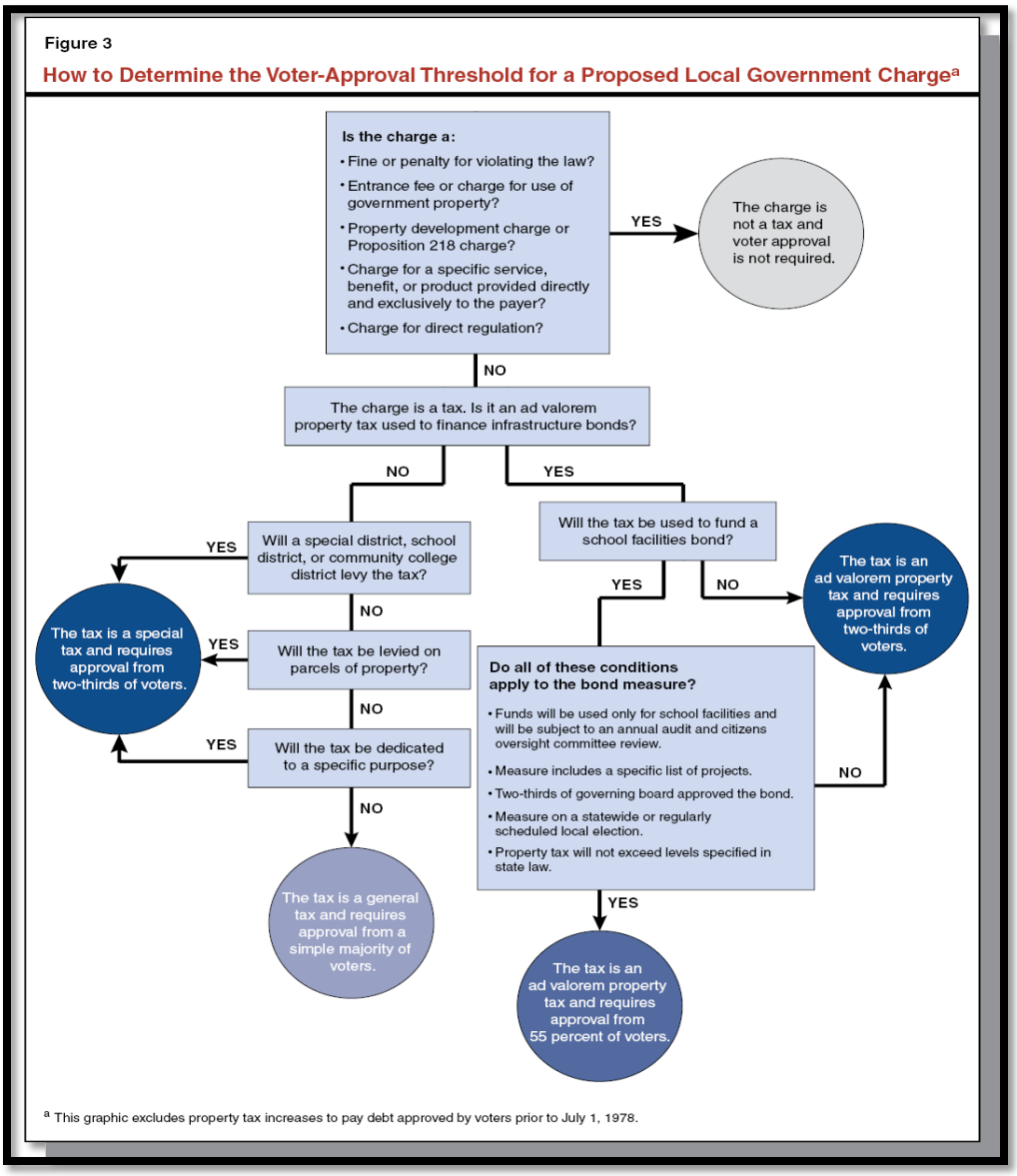
The City, by City Charter and State law, may not spend public funds without the legal authorization to do so. Among other things, a budget appropriates public funds, thereby providing the legal authorization from the governing body to expend these funds. The City shall adopt by resolution a final budget for that fiscal year at or before its first regular meeting held in such fiscal year. In addition, the City shall annually establish its appropriations limit related to the proceeds from taxes in compliance with Article XIIIB of the California Constitution and Cal. Government Code Sec 7910.

[5] Ibid
[6] City of Chico 2016-17 Final Annual Budget, Adopted June 21, 2016

The appropriations limit is established as a part of an annual budget and must be reviewed as a part of an annual financial audit.[7]

The City Charter and State law allows for the establishment of a variety of sales, use and property transfer taxes. Any increases must be placed on the ballot by the City Council and approved by the City's voters. Depending on the tax, any voter approved increase must pass with a simple or a two-thirds majority.

Figure 1: Voter Thresholds for Proposed Local Government Charges[8]



[7] The Charter of the City of Chico, accessed online at http://library.amlegal.com/nxt/gateway.dll/California/chico_ca/chicomunicipalcode?f=templates$fn=default.htm$3.0$vid=amlegal:chico_ca

[8] Ibid

Property tax law in California revolves around a 1978 voter initiative that is still referred to by its decades-old ballot identification: Proposition 13. Proposition 13 froze the basic tax rate and limited the assessed value of property to the value at sale plus no more than 2% a year. Property taxes typically are directly proportional to property values. If home values go up, property taxes go up. When home values declined steeply during the recession, property tax revenue fell significantly as well.

The City's Finance Department has projected revenue for fiscal year 2016-17 to increase 2% over 2015-16. The City has assumed an industry-wide assumption of 3% for revenue growth between 2017 and 2021. For the same time frame, total expenditures are projected to decline by 1% in 2016-17, remain flat in 2017-18 and grow at 2% each year through 2021. It is important to note that budget projections did not include allocated funds to replace SAFER revenue.

Figure 2: Five-Year General & Park Funds Budget Projection – Maintain Current Service Levels[9]

City of Chico
FY2016-17 Annual Budget
General & Park Funds Five-Year Projection - Funds 001 & 002
Scenario 1 - Maintain Current Service Levels

	MODIFIED ADOPTED 2015-16	COUNCIL ADOPTED 2016-17	PROJECTED 2017-18	PROJECTED 2018-19	PROJECTED 2019-20	PROJECTED 2020-21
REVENUES						
Sales Tax	$ 20,573,739	$ 21,124,000	$ 21,680,000	$ 22,186,000	$ 22,792,000	$ 23,398,000
Property Tax	6,756,068	7,482,000	7,678,000	7,926,000	8,174,000	8,423,000
Property Tax In Lieu of VLF	6,993,895	7,375,000	7,600,000	7,800,000	8,000,000	8,200,000
Utility Users Tax	6,261,705	6,674,000	6,839,000	7,006,000	7,176,000	7,358,000
Transient Occupancy Tax	2,454,471	2,500,000	2,600,000	2,700,000	2,800,000	2,900,000
Other Taxes	2,286,889	2,263,500	2,322,500	2,382,500	2,445,500	2,509,500
Total Tax Revenues	**45,326,767**	**47,418,500**	**48,719,500**	**50,000,500**	**51,387,500**	**52,788,500**
Change from prior year	***1%***	***5%***	***3%***	***3%***	***3%***	3%
All Other Revenues	2,452,926	1,438,600	1,473,400	1,509,600	1,547,900	1,587,300
TOTAL REVENUE	**47,779,693**	**48,857,100**	**50,192,900**	**51,510,100**	**52,935,400**	**54,375,800**
Change from Prior Year	***1%***	***2%***	***3%***	***3%***	***3%***	3%
EXPENDITURES						
Salaries and Benefits	36,931,939	37,890,484	39,156,357	40,062,032	41,170,365	41,926,927
Materials, Services & Supplies	1,100,792	1,019,462	1,044,949	1,071,072	1,097,849	1,125,295
Purchased Services	2,093,050	1,957,725	2,006,668	2,056,835	2,108,256	2,160,962
Other Expenses	1,382,593	1,287,686	1,319,878	1,352,875	1,386,697	1,421,364
Allocations	6,640,703	6,695,459	6,612,845	6,778,167	6,947,621	7,121,311
Indirect Cost Allocation	(1,969,030)	(1,969,030)	(1,969,030)	(1,969,030)	(1,969,030)	(1,969,030)
Total Operating Expenditures	**46,180,047**	**46,881,786**	**48,171,667**	**49,351,951**	**50,741,758**	**51,786,830**
Capital Improvement Projects	3,664,011	2,215,399	969,421	762,251	382,250	425,165
TOTAL EXPENDITURES	**49,844,058**	**49,097,185**	**49,141,088**	**50,114,202**	**51,124,008**	**52,211,995**
Change from Prior Year	***24%***	***-1%***	***0%***	***2%***	***2%***	***2%***
NET REVENUE OVER/(UNDER) EXPENDITURES BEFORE OTHER SOURCES (USES)	**(2,064,365)**	**(240,085)**	**1,051,812**	**1,395,898**	**1,811,392**	**2,163,805**
OTHER FINANCING SOURCES (USES)						
Other Financing Sources	2,653,281	3,663,579	2,250,000	2,250,000	2,250,000	2,250,000
Other Financing Uses	(3,871,645)	(3,772,449)	(3,820,000)	(3,820,000)	(3,820,000)	(3,920,000)
TOTAL OTHER SOURCES (USES)	**(1,218,364)**	**(108,870)**	**(1,570,000)**	**(1,570,000)**	**(1,570,000)**	**(1,670,000)**
NET REVENUE/(DEFICIT)	**(3,282,729)**	**(348,955)**	**(518,188)**	**(174,102)**	**241,392**	**493,805**
BEGINNING FUND BALANCE	3,960,676	677,947	328,992	(189,196)	(363,299)	(121,906)
ENDING FUND BALANCE	**$ 677,947**	**$ 328,992**	**$ (189,196)**	**$ (363,299)**	**$ (121,906)**	**$ 371,899**
Desired Operating Reserve	***$ 3,464,000***	***$ 3,516,000***	***$ 3,610,000***	***$ 3,700,000***	***$ 3,810,000***	***$ 3,880,000***

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[9] Ibid

Area Description

Geography

Chico is at the Northeast edge of the Sacramento Valley approximately 90 miles North of Sacramento. The Sierra Nevada Mountains lie to the East, with Chico's city limits extending several miles into the foothills. To the west, the Sacramento River lies five miles from the city limits.

The CFD is a mix of urban and suburban bisected East and West by State Highway 99, a freeway of at least four lanes in each direction. The City is also bisected North and South by Bidwell Park, which makes up over 17% of the city.

Topography

Chico sits on the Sacramento Valley floor close to the foothills of the Sierra Nevada range to the East and South and the Cascade Range to the North. Big Chico Creek is the demarcation line between the ranges. The city's terrain is generally flat with increasingly hilly terrain beginning at the Eastern city limits.[10] The city is bisected by Bidwell Park, which runs five miles from the flat city center into the foothills to the East. The Northern Sacramento Valley is one of the most productive agriculture regions in California with farms, orchards and ranches surrounding the City.

The City is also traversed by two creeks and a flood channel, which feeds the Sacramento River. They are named Big Chico Creek, Little Chico Creek, and Lindo Channel (also known as Sandy Gulch).

The City's urban forest creates a significant sense of pride and community identity, and is recognized as a key component of the community design element. Since 1984, the City of Chico has been designated as a 'Tree City USA' by the National Arbor Day Foundation.[11]

Climate

Chico experiences a Mediterranean climate, marked by hot summers and wet winters. Temperatures can rise well above 100 °F in the summer. Winters are mild and wet, with the most rainfall coming in January. July is usually the warmest month, with an average high temperature of 94 °F, and January is the coolest month, with an average high temperature of 55 °F. The average annual rainfall is 27 inches. Thick ground fog, known as Tule Fog is often present during the autumn and winter months. Winds are typically mild except for passing winter storms and North winds generated during wildland fire season.

[10] Chico Geography and Topography, accessed online at https://en.wikipedia.org/wiki/Chico,_California#Geography
[11] Chico Urban Forest Master Plan, accessed online at http://www.chico.ca.us/general_services_department/park_division/street_trees.asp

Population and Demographic Features

The CFD serves a total population of approximately 89,180 within a geographic area of approximately 33 square miles, including the 119 acres housing the Central Campus of California State University, Chico and a student population of 17,220.[12]

The figure below provides various metrics of census data for Chico and the State of California.

Table 1: Census Data for Chico City and State of California[13]

People Quick Facts	Chico	California
Population estimates, July 1, 2015, (V2015)	89,180	39,144,818
Population estimates base, April 1, 2010, (V2015)	86,401	37,254,503
Population, percent change - April 1, 2010 (estimates base) to July 1, 2015, (V2015)	4.5%	5.1%
Population, Census, April 1, 2010	86,187	37,253,956
Persons under 5 years, percent, April 1, 2010	5.7%	6.8%
Persons under 18 years, percent, April 1, 2010	19.5%	25.0%
Persons 65 years and over, percent, April 1, 2010	10.6%	11.4%
Female persons, percent, April 1, 2010	50.4%	50.3%
White alone, percent, April 1, 2010	80.8%	57.6%
Black or African American alone, percent, April 1, 2010	2.1%	6.2%
American Indian and Alaska Native alone, percent, April 1, 2010	1.4%	1.0%
Asian alone, percent, April 1, 2010	4.2%	13.0%
Native Hawaiian and Other Pacific Islander alone, percent, April 1, 2010	0.2%	0.4%
Two or More Races, percent, April 1, 2010	5.0%	4.9%
Hispanic or Latino, percent, April 1, 2010	15.4%	37.6%
White alone, not Hispanic or Latino, percent, April 1, 2010	73.7%	40.1%
Living in same house 1 year ago, percent of persons age 1 year+, 2010-2014	69.2%	84.6%
Population per square mile, 2010	2617.8	239.1
Language other than English spoken at home, percent of persons age 5 years+, 2010-2014	14.2%	43.8%
High school graduate or higher, percent of persons age 25 years+, 2010-2014	91.4%	81.5%
Bachelor's degree or higher, percent of persons age 25 years+, 2010-2014	34.9%	31.0%
Veterans, 2010-2014	4,691	1,840,366
Mean travel time to work (minutes), workers age 16 years+, 2010-2014	17.2	27.6
Housing units, April 1, 2010	37,050	13,680,081
Owner-occupied housing unit rate, 2010-2014	43.8%	54.8%
Median value of owner-occupied housing units, 2010-2014	$263,100	$371,400
Households, 2010-2014	34,314	12,617,280
Persons per household, 2010-2014	2.45	2.95
Per capita income in past 12 months (in 2014 dollars), 2010-2014	$24,775	$29,906
Median household income (in 2014 dollars), 2010-2014	$42,334	$61,489
Persons in poverty, percent	24.5%	16.4%

[12] Chico Facts, Public Affairs and Publications, CSU Chico, accessed online http://www.csuchico.edu/pa/chico-facts.shtml
[13] US Census 2015 Estimates. Retrieved from http://www.census.gov/quickfacts/table/HSD410214/06,0613014

Disaster Potentials

The City is vulnerable to the natural hazards of wildland urban interface fire, drought, flooding, severe storms, earthquakes and landslides.

The City is vulnerable to technological (human-caused) hazards associated with transportation accidents via rail and highway, urban fire, hazardous materials spills, Chemical, Biological, Radiological, Nuclear, and Explosive (CBRNE) terrorism, civil disturbances, multi-casualty incidents, and some risk associated with dam failure and inundation. Additionally, in this era, no community is immune to the potential for active shooter incidents.

Chico State University also creates disaster potential through the storage, use and disposal of hazardous materials, on and off campus fires involving students and multi-casualty incidents.

SERVICES PROVIDED

Service Delivery Programs

Fire Suppression

The CFD provides high quality fire suppression services within the jurisdiction as well as response to requests for service from adjacent agencies. Fire suppression services are provided from six fixed facility fire stations distributed throughout the community. All Department members are minimally trained as firefighters and emergency medical technicians (EMTs). In addition, all members are trained to the hazardous materials first responder operational-decontamination level and for confined space and swiftwater awareness, and for rescue systems.

In total, the Department operates the following response units: (budgeted for staffing of 22 per day)

- 5 fire engines companies (four dedicated and one is primarily used for relief staffing)
- 1 ladder company
- 1 squad company (primarily used for relief staffing, but is staffed to meet designated hazard, call volume needs)
- 1 aircraft crash rescue company (cross-staffed with one fire engine)
- 1 Division Chief Command unit.

The Department has also established minimum staffing levels in an effort to accommodate employee leave and budget constraints. Therefore, at a minimum, the department will deploy the following: (Minimum staffing of 17)

- 4 fire engines companies
- 1 ladder company
- 1 aircraft crash rescue
- 1 Division Chief Command unit.

Rescue

The City operates a 14-person Technical Rescue Team in conjunction with the Butte Interagency Rescue Group, which is capable of providing advanced rescue capabilities for risks such as urban search & rescue, confined space rescue, swift water rescue, dive water rescue, high and low angle rope rescue, trench rescue, helicopter rescue, and large animal rescue.

Emergency Medical Services

The CFD provides emergency Basic Life Support (BLS) first responder level care for the sick and injured throughout the Department. This is accomplished using engine, ladder and squad companies utilized as first responders and partnering with Butte County EMS and their exclusive contractor First Responder Emergency Medical Services, Inc. for ALS Medic Unit for advanced care, treatment, and transport to the hospital. All of the Department's fire suppression apparatus provide first response

for BLS and ALS level incidents. All of the department's EMTs are certified for application of advanced skills, advanced airways, AED, and tourniquets.

Hazardous Materials

The CFD operates as part of a regional Hazardous Materials (HazMat) response team that has advanced capabilities for detection of and mitigation of risks. The regional team is recognized as a Type 2 Team by the State of California Officer of Emergency Services, Fire & Rescue Branch. All 12 members of the hazmat team are trained to the Hazardous Materials Specialist Level (6 weeks) and all Company Officers are trained to the Hazardous Materials Incident Commander Level.

Current Deployment Strategy

Fire Stations

The CFD utilizes six fixed fire station facilities to effect fire suppression, emergency medical, and special operation responses. Below is the brief overview of the fire station locations, capabilities, and staffing.

Station 1: City of Chico Fire Station 1 is located at 842 Salem Street, Chico, CA 95928.

Station 1's allocated capital and human resources are provided below.

Table 2: Station 1 Resources

Apparatus	Apparatus Type	Number of Personnel Assigned
T1	Truck	4
SQ1	Squad	2*
BS1	Breathing Support	
UT1	Utility	

* Squad personnel are utilized to fill vacancies (vacation, sick, work comp, etc.) on constantly staffed apparatus. There are times where the department will hire overtime to strategically staff the squad to meet the specific risks/hazards of the day.

Station 2: City of Chico Fire Station 2 is located at 182 East 5th Avenue, Chico, CA 95926.

Station 2's allocated capital and human resources are provided below.

Table 3: Station 2 - Resources

Apparatus	Apparatus Type	Number of Personnel Assigned
E2	Engine	4*
R2	Rescue	Cross-staffed
E2R	Engine (Reserve)	
UT2	Utility	

* One of the positions is utilized to cover leave Department-wide.

Station 3: City of Chico Fire Station 3 is located at 145 Boeing Avenue, Chico, CA 95973.

Station 3's allocated capital and human resources are provided below.

Table 4: Station 3 Resources

Apparatus	Apparatus Type	Number of Personnel Assigned
E3	Engine	3*
CR3	Aircraft Crash Rescue	Cross-staffed
CR3R	Aircraft Crash Rescue (Reserve)	
UT3	Utility	

* The Fire Apparatus Engineer and Firefighter are used to cover leave. Engine 3 is down-staffed approximately 90% of the time when personnel are covering leave. Remaining personnel will only staff Crash Rescue. If engine is down-staffed, remaining personnel will respond in a utility to confirmed structure fires as a Safety Officer.

Station 4: City of Chico Fire Station 4 is located at 2405 Notre Dame Boulevard, Chico, CA 95928.

Station 4's allocated capital and human resources are provided below.

Table 5: Station 4 Resources

Apparatus	Apparatus Type	Number of Personnel Assigned
E4	Engine	3
OES 8332	Wildland Engine (Type III) Reserve	

Station 5: City of Chico Fire Station 5 is located at 1777 Manzanita Avenue, Chico, CA 95926.

Station 5's allocated capital and human resources are provided below.

Table 6: Station 5 Resources

Apparatus	Apparatus Type	Number of Personnel Assigned
E5	Engine	3
E15	Wildland Engine (Type III)	Cross-staffed
HM5	Hazmat	Cross-staffed

Station 6: City of Chico Fire Station 6 is located at 2544 Highway 32, Chico, CA 95973.

Station 6's allocated capital and human resources are provided below.

Table 7: Station 6 Resources

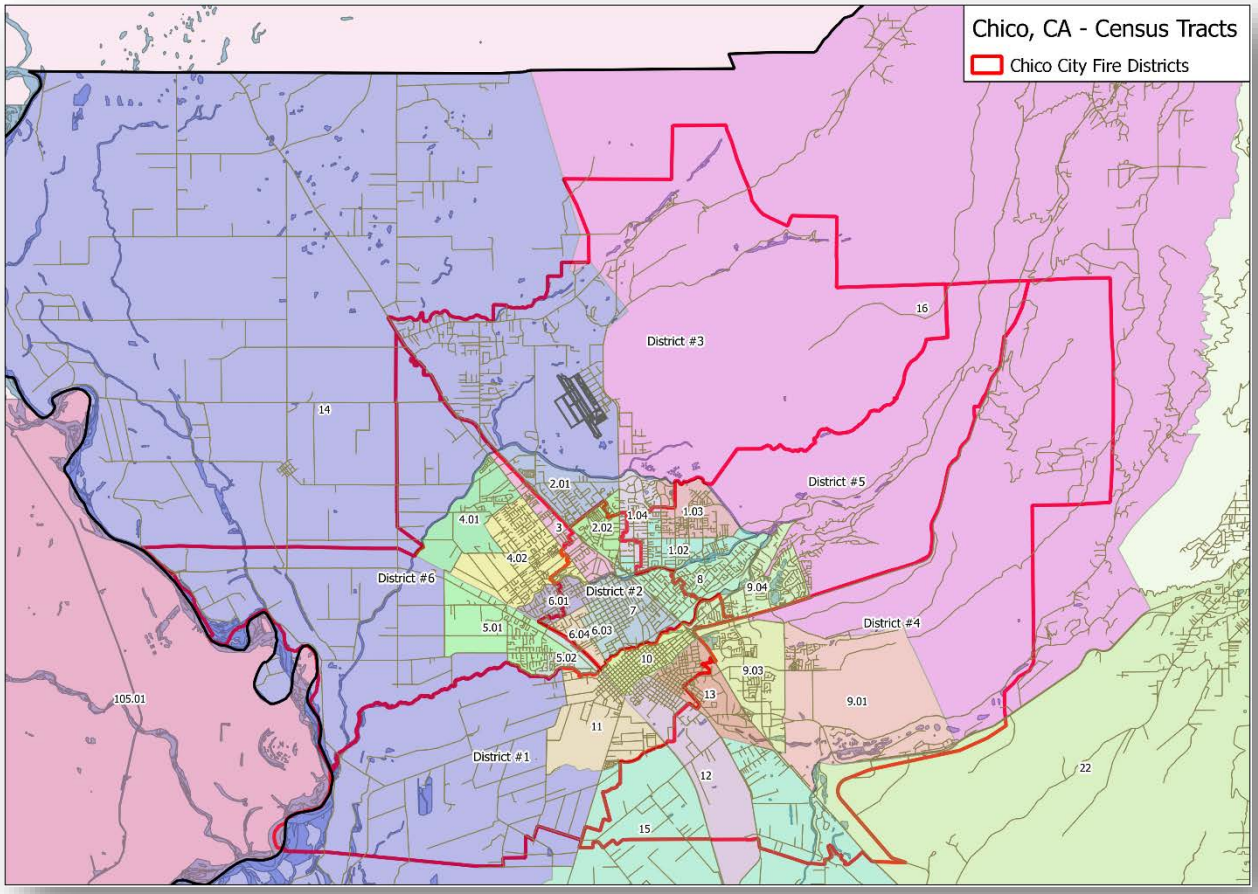
Apparatus	Apparatus Type	Number of Personnel Assigned
E6	Engine	3
OES 297	State of California OES Engine (Type I)	

Response Areas

Consistent with the station distribution model currently utilized by the Department, there are six distinct station response zones.

The fire station response territories have been utilized as the station Fire Demand Zones (FDZ) or station still alarm area, for all planning aspects for managing risk, demand, and performance. A map of the fire department demand zones is provided below.

Figure 3: City of Chico Fire Department



Apparatus

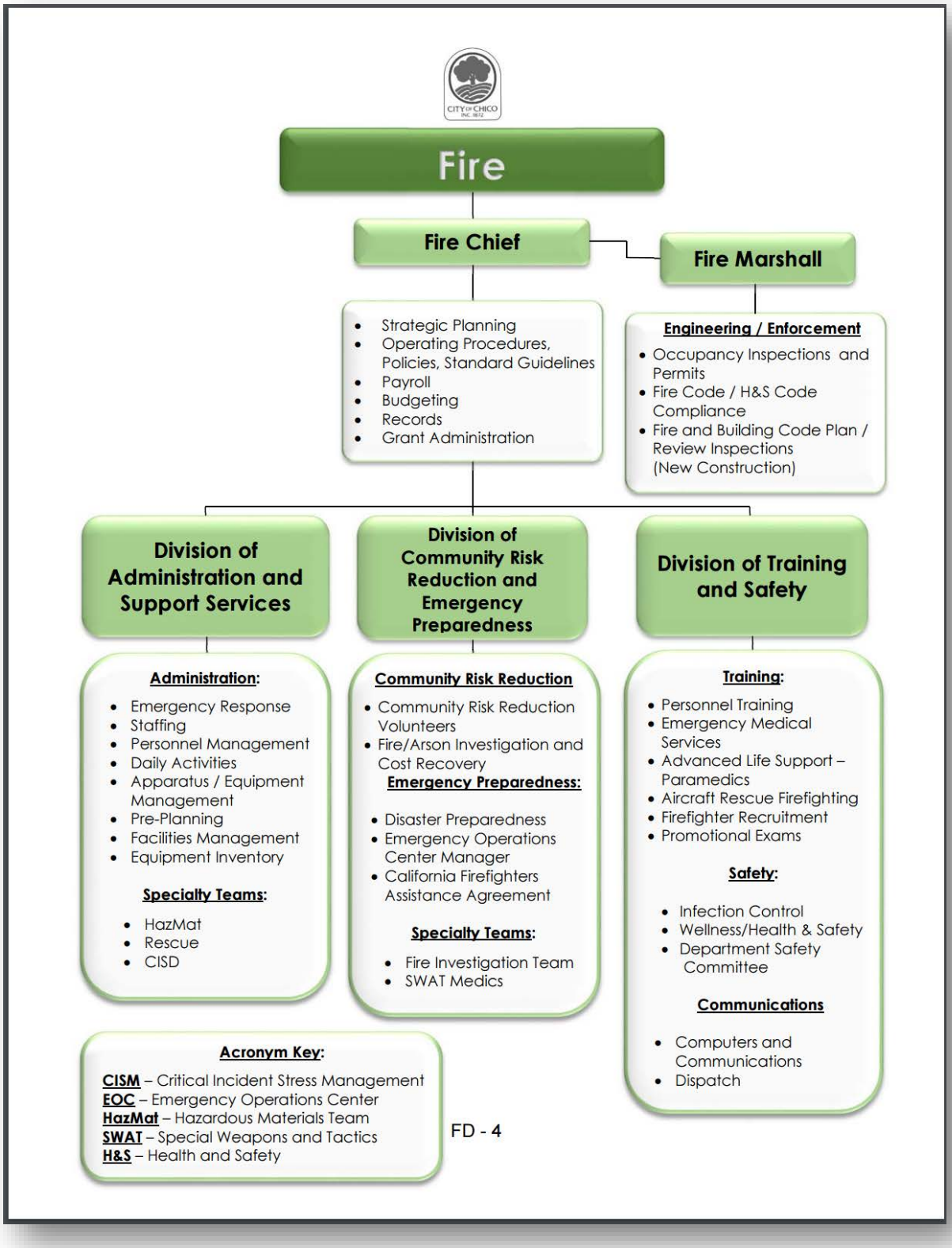
Each of the Department's daily apparatus and unit identifiers have been previously presented in the description of the Fire Stations. However, a full and detailed listing of all Department vehicles is presented as Attachment A.

Current Staffing Strategy

Organizational Structure

The CFD operates from six fire stations with its Headquarters collocated with Fire Station 1. The following organizational chart below illustrates the general organizational structure of the Department.

Figure 4: Chico Fire Department Organizational Chart



The Department's organizational structure reflects a typical, paramilitary organization. The Executive Team is comprised of five senior uniformed officers, including the Fire Chief, Fire Marshal and three Division Chiefs. Primary responsibility for the administration and management of the department's budget rests with the Fire Chief. The Fire Marshal is distinguished primarily by the functional areas of responsibility of Engineering and Enforcement. The three Division Chiefs function as the Operations shift supervisors and have designated areas of responsibility which include Administration and Support Services, Community Risk Reduction and Emergency Preparedness, and Training and Safety.

Among the line/response personnel, the next level is 18 Fire Captains who perform individual station / company supervision.

Administration, Emergency Services and Support Staff

As noted above, the administrative team consists of the Fire Chief, Fire Marshal and three Division Chiefs. One additional fire prevention specialist and one additional fire inspector are assigned to the Fire Prevention Bureau ensuring compliance with fire codes, issuing permits, conducting inspections and plan checks.

Emergency services for the City including managing the Emergency Operations Center, rest with the Department. These responsibilities are assigned to one of the Division Chiefs.

Support services for the Department include two administrative analysts.

COMMUNITY RESPONSE HISTORY

Methodology

We collected three different data sets: 2013-2015 of CAD data, 2013 SunGard NFIRS data and 2014 and 2015 ERS NFIRS data. We cross-validated CAD and NFIRS databases. In this report, we primarily focused our analysis on the 2015 calendar year. We discussed three years' baseline workload and response time performances in the last section.

In this report, we utilized two distinct measures of call volume and workload. First, is the number of requests for service that are defined as either "dispatches" or "calls". Dispatches/calls are the number of times a distinct incident was created involving Chico Fire Department units or Calls in Chico Fire Department's jurisdiction. Conversely, "responses" are the number of times that an individual unit (or units) responded to a call. Responses will be utilized on all Unit and Station level analyses, which account for all elements of workload and performance. Calls have been categorized as EMS, Fire, Rescue, Hazard, Mutual/Auto Aid, and Canceled, respectively. We classified call types in a series of steps. We first identified cancelled calls requiring either the NFIRS incident type indicating canceled calls or all dispatched Chico units had identical unit arriving on scene time and unit available time (zero on task time). Then we identified mutual and automatic aid calls from Chico Fire Department's perspective using the NFIRS Mutual/Auto Aid, CAD jurisdiction and call disposition data. Then, we used NFIRS incident type to assign EMS, MVA, fire category, rescue, and HazMat call types. Lastly, for NFIRS EMS calls, we used the CAD call description to assign granular EMS categories. For calls, which were missing NFIRS reports, CAD call description was used to assign call type.

Since 2015, most of out of county mutual aid responses were tracked manually as HR records, and thus excluded in this data report. In the majority body of the report, we only discuss calls with at least one dispatched Chico unit. In figure 140, we discuss interactions between Chico Fire Department and the County Fire Department. Currently, the CAD data only captures the time a dispatcher created the call, not the time a citizen dialed 911. The dispatch time or alarm handling time in this report is defined as the interval from the call entry time to the unit dispatched time, which only accounts for a portion of the whole dispatch process. Thus, the response time does not include the time from a citizen dialed 911 through the time a dispatcher entered the request into CAD. This is not considered as best practice and serves to artificially report performance.

Overview of Community Response Performance

In the year of 2015, CFD responded to a total of 10,738 requests for service, or dispatches. EMS service requests totaled 6,824, accounting for 63.6% of the total number of incidents. The number of fire related calls were 1,959, which accounted for 18.2% of the dispatched incidents. Canceled calls

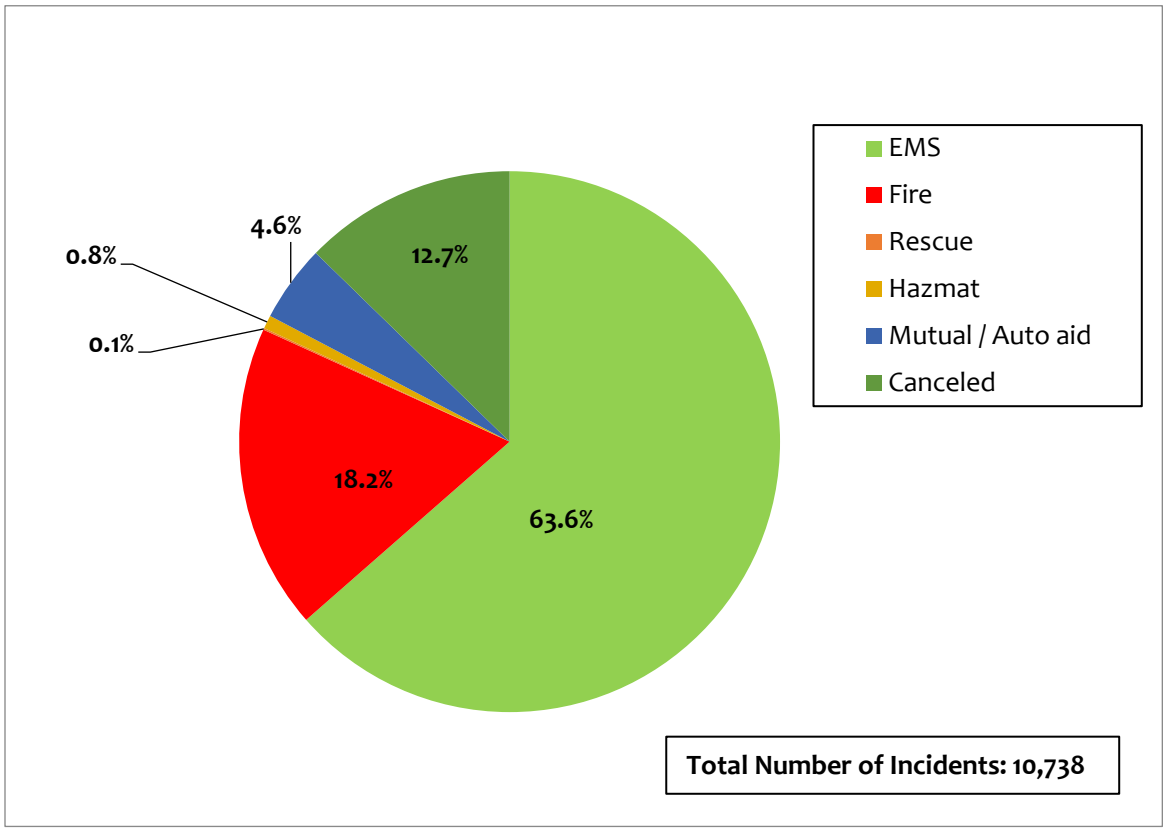
accounted for 12.7% of the total. A total of 493 incidents (4.6 percent) were Mutual/Auto Aids in the county jurisdiction.

The number of individual unit responses will be more reflective of total department workload since 14% of the calls resulted in multiple units dispatched. As summarized below all units in CFD combined made 13,409 responses, and were busy on emergency calls 3,669 hours. On average, each response lasted 16.4 minutes from dispatched to clear.

Table 8: Number of Incidents Dispatched by Category – 2015

Call Category	Number of Calls	Calls per Day	Call Percentage
Cardiac and stroke	590	1.6	5.5%
Seizure and unconsciousness	894	2.4	8.3%
Breathing difficulty	653	1.8	6.1%
Overdose and psychiatric	376	1.0	3.5%
MVA	601	1.6	5.6%
Fall and injury	1,032	2.8	9.6%
Illness and other	2,678	7.3	24.9%
EMS Total	**6,824**	**18.7**	**63.6%**
Structure fire	92	0.3	0.9%
Outside fire	268	0.7	2.5%
Vehicle fire	26	0.1	0.2%
False alarm	436	1.2	4.1%
Good intent	98	0.3	0.9%
Public service	727	2.0	6.8%
Fire other	312	0.9	2.9%
Fire Total	**1,959**	**5.4**	**18.2%**
Rescue	**11**	**0.0**	**0.1%**
Hazmat	**86**	**0.2**	**0.8%**
Mutual/Auto Aid	**493**	**1.4**	**4.6%**
Canceled	**1,365**	**3.7**	**12.7%**
Total	**10,738**	**29.4**	**100.0%**

Figure 5: Percentage of Total Incidents Dispatched by Category



Again, the number of individual unit responses will be more reflective of total department workload since 14% of the calls resulted in multiple units dispatched. As summarized below, all units in Chico combined made 13,409 responses, and were busy on emergency calls 3,669 hours. On average, each response lasted 16.4 minutes from dispatched to clear.

Table 9: Number of Responses, and Total Busy Time by Category – 2015

Program	Number of Calls	Number of Responses	Average Responses per Call	Total Busy Hours	Average Busy Minutes per Response
EMS	6,824	7,673	1.1	1,837	14.4
Fire	1,959	3,183	1.6	1,171	22.1
Rescue	11	23	2.1	24	62.3
Hazmat	86	293	3.4	156	31.9
Mutual/Auto Aid	493	631	1.3	252	24.0
Canceled	1,365	1,606	1.2	228	8.5
Total	**10,738**	**13,409**	**1.2**	**3,669**	**16.4**

This analysis focused on lights and sirens responses and utilized the first arriving units of all distinct incidents excluding Mutual/Auto Aid and canceled incidents. The mean (average) dispatch time was 42 seconds. The mean (average) turnout time was 66 seconds (one minute and 6 seconds), travel time was 204 seconds (three minutes 24 seconds), turnout and travel time was 264 seconds (four minutes 24 seconds), and response time was 312 seconds (five minutes and 12 seconds). The average response time is the same as the sum of the average dispatch time and turnout and travel time.

However, a more conservative and reliable measure of performance is the fractile or percentile. This measure is an industry best practice and is more robust, or less influenced by outliers, than measures of central tendency such as the mean. Best practice is to measure at the 90th percentile. In other words, 90% of all performance is captured expecting that 10% of the time the department may experience abnormal conditions that would typically be considered an outlier. For example, if the department were to report an average response time of six minutes, then in a normally distributed set of data, half of the responses would be longer than six minutes and half of the responses would be less than six minutes. The 90th percentile communicates that 9 out of 10 times the department performance is predictable and thus more clearly articulated to policy makers and the community.

The performance for dispatch time at the 90th percentile was 82 seconds (one minute and 22 seconds), turnout time at the 90th percentile was 118 seconds (one minutes and 58 seconds), travel time was 316 seconds (five minutes and 16 seconds), turnout and travel time was 395 seconds (six minutes and 35 seconds), and response time was 440 seconds (seven minutes and 20 seconds). Please note that the summation of 90th percentile turnout time and 90th percentile travel time is not the same as 90th percentile turnout and travel time combined, and also the summation of 90th percentile dispatch time, 90th percentile turnout time and 90th percentile travel time is not the same as 90th percentile response time.

Table 10: Average Turnout and Travel Time by Category (time in minutes)

Program	Dispatch Time	Turnout Time	Travel Time	Turnout and Travel	Response Time	Sample Size
EMS	0.7	1.0	3.3	4.3	5.0	6,592
Fire	0.9	1.2	3.7	5.0	5.8	1,171
Rescue	1.0	0.9	4.2	5.1	6.1	5
Hazmat	1.1	1.2	3.7	4.8	5.9	74
Total	**0.7**	**1.1**	**3.4**	**4.4**	**5.2**	**7,842**

Table 11: 90th Percentile Turnout and Travel Time of First Arriving Units by Call Category (time in minutes)

Program	Dispatch Time	Turnout Time	Travel Time	Turnout and Travel	Response Time	Sample Size
EMS	1.3	1.9	5.1	6.4	7.2	6,592
Fire	1.7	2.2	6.0	7.4	8.4	1,171
Rescue	1.5	1.5	8.4	9.9	11.1	5
Hazmat	2.8	2.0	5.4	7.1	7.8	74
Total	**1.4**	**2.0**	**5.3**	**6.6**	**7.3**	**7,842**

Typically, performance varies across call types or categories due to a variety of reasons. For example, the turnout time may be longer for fire related calls because the crews must dress in their personal protective ensemble (bunker gear) prior to leaving the station whereas on an EMS incident they do not. In addition, crews staffing multiple apparatus (cross-staffed) will have longer turnout times as personnel and gear are moved between multiple apparatus. Similarly, the larger fire apparatus may require longer response times due to their size and lack of maneuverability, specifically noted in Station 1's area where the ladder truck handles most responses. However, the data only includes emergency responses; data does suggest mean and 90th percentile turnout time for fire calls were longer than EMS calls. As expected, significant variability is introduced in responses for rescue calls. Since there are only combined 5 calls used in this analysis, the 90th percentile is essentially the longest time.

COMMUNITY EXPECTATIONS & PERFORMANCE GOALS

Stakeholder Input Process

The organization completed a strategic planning process in conjunction with the standards of response coverage document. A summary of the results of the stakeholder input process of the strategic planning process is provided here.

Community Expectations

The process utilized by the department to evaluate community expectations was through structured interviews and interaction with chief officers, City Staff, key community stakeholders and line personnel. The representativeness of the organizational structure and continuous community interactions contributed to the assessment of community expectations.

In addition, an external stakeholder group was invited to attend a lunch meeting where the stakeholders were asked to prioritize services provided by the department as well as provide general feedback for the department.

Guiding Principles and Internal Performance Expectations and Goals

Mission

To provide the highest quality fire, rescue, emergency medical, and disaster response services to the Chico community in a caring and professional manner.

Goals

- Exercise sound financial judgment and plan for fiscal sustainability
- Deliver excellent service while focusing on innovation and improvement
    - Deliver service commensurate with Community Expectations, Strategic Community Risk Reduction, and data-driven needs
- Internal and External Communication
- Plan for technology improvements and maintenance to meet the operational needs of the Department
- Develop and expand on existing partnerships to build trust and explore collaborative opportunities
- Develop and manage infrastructure to support operations and innovations now and for the future
- Hire, develop, take care of and promote the best people
- Build community trust and resilience through education, engagement, and transparency

COMMUNITY RISK ASSESSMENT AND RISK LEVELS

Risk Assessment Methodology

Methodology

The risk assessment process utilized a systematic methodology to evaluate the unique risks that are specific to the CFD. This process evaluated risk from two broad perspectives. First, risk is identified through retrospective analyses of historical data. Second, risk is evaluated prospectively providing the necessary structure to appropriately allocate personnel, apparatus, and fire stations that afford sufficient distribution and concentration of resources to mitigate those risks. This methodology also provides information for the Department to consider alternative solutions to assist in the mitigation of risks.

Service areas that either had little quantitative data, or did not require that level of analysis, were evaluated through both retrospective analysis as well as structured interviews with Department staff members. In an effort to improve clarity, the following terminology is used for the remainder of the risk assessment description and analyses: retrospective risk will use the term Community Service Demands and prospective risk will use the term Community Risks.

The overall community risk assessment process and methods utilized by CFD is presented below.[14]

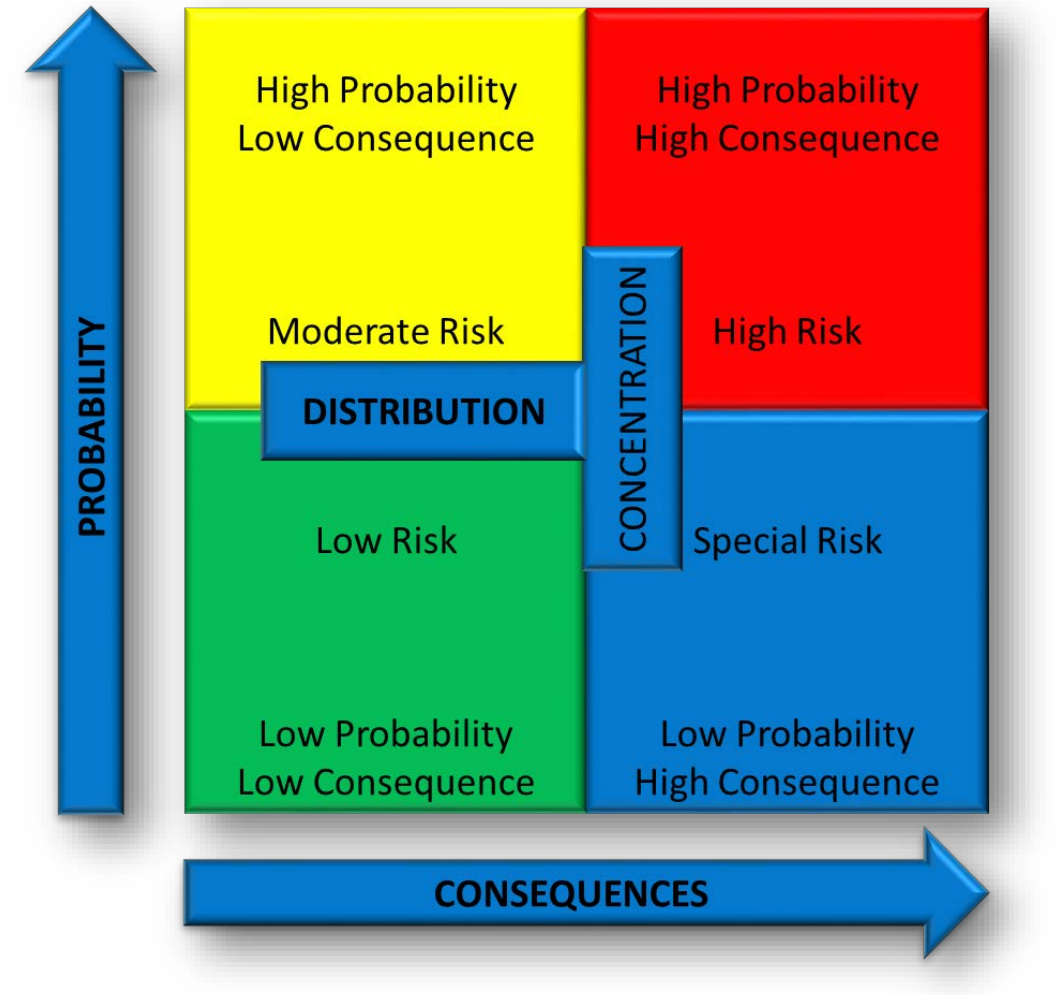
Figure 6: Community Risk Assessment Process

[14] Olathe Fire Department. (2012). Adapted from Community Risk and Emergency Services Analysis: Standard of Cover. Olathe, Kansas: Author.

Community service demands were analyzed by the incident history, type, locations, and incident frequencies. Within this process a temporal analysis was completed for each major program area and evaluated by station demand zone and the frequency of incidents. Community risks were evaluated by each program area and risks are identified in each demand zone.

This methodology not only provides for sufficient allocation of resources to manage the readiness or preparedness aspects of the deployment strategy, but also balances the costs of readiness with an in-depth understanding of the probability of events through historical analyses. The combined results of this process were utilized to classify risk by severity utilizing a probability and consequence matrix for each program/risk area. Finally, the critical tasks required for each level of risk were identified. An example of the overall probability and consequence matrix is provided below.[15]

Figure 7: Probability and Consequence Matrix



[15] CFAI. (2009). Fire & Emergency Service Self-Assessment Manual, 8th (ed.). Chantilly, Virginia: Author. (p. 49)

Planning Areas/Zones

The Department utilizes the existing station demand zones for their planning efforts. For example, the company officers from each fire station zone is responsible for fire prevention efforts, building familiarity, etcetera within the planning demand zone. Therefore, the planning zones remained consistent throughout the risk assessment process. The station demand zones have served the department well in this process as risk has been evaluated for both the distribution of resources and the necessary concentration of resources to meet each demand zone's specific and unique risks.

Additional analyses per fire demand zone are presented under the heading "Comparison of Demand Zones."

Community Characteristics of Risk[16]

Geographic and Weather-Related Risks

1. Climate Change
   - *The nature and extent of this threat contains limited documentation. The most important effect is that climate change will likely have a measurable impact on the occurrence and severity of natural hazards.*
   - *The change most closely associated with this risk is that projected temperature warming is expected to increase extreme heat events and decrease extreme cold events.*
2. Drought and Water Shortage
   - *Marked by a slow onset and usually has a distinct event.*
   - *The most impacts associated with drought is related to water intensive activities such as wildfire protection and municipal usage.*
   - *Cyclical, and is driven by weather patterns.*
   - *Ranked as Likely Occurrence for City.*
3. Earthquakes
   - *The only known active fault in Butte County is the Cleveland Hills fault, the site of the August 1975 Oroville earthquake. This earthquake had a Richter magnitude of 5.7.*
   - *Studies suggest that earthquakes of a Magnitude 5.7 or greater have occurred in the region and that similar seismic events are possible in the future.*
   - *Several other active faults in nearby counties that could impact the City.*
   - *Ranked as Occasional Occurrence for City.*
4. Extreme Heat
   - *Temperatures more than 100 degrees have been recorded in May through October.*
   - *Health impacts are the primary concern with this hazard.*
   - *The elderly and individuals below the poverty level are the most vulnerable.*

[16] Butte County. (2013). *Local Hazard Mitigation Plan Update, Annex B, City of Chico,* Butte County, CA: Author. Retrieved from https://www.buttecounty.net/Portals/19/LHMP/Butte_County_LHMP_Update_Annex_B_City_of_Chico.pdf

- *Nursing homes and elder care facilities are especially vulnerable to extreme heat events if power outages occur and air conditioning is not available.*
- *Ranked as Highly Likely Occurrence for City.*

5. Fire
   - *The principal structural fire threats for the City stems from the built environment, both commercial and residential occupancies.*
   - *The wildland fire season typically begins in early June and ends in late October due to cooler weather and higher precipitation.*
   - *15% of property parcels in City are in designated Moderate and High Fire Danger Zones, nearly all on the east side of Highway 99.*
   - *None of the State's major wildland fires have occurred in Chico.*
   - *Ranked as Highly Likely Occurrence for City.*
   - *Significant inventory of unprotect structures by either lack of sprinkler system, lack of alarm systems, or both.*
   - *According to the latest FBI Arson Statistics, the City of Chico has one of the highest per capita arson rates in California.*[17]
6. Flooding
   - *The primary flooding threat comes from the Big Chico Creek Watershed, Little Chico Creek Watershed. Those areas most prone to flooding are zoned to minimize the risk to life and property.*
   - *Additional flooding threats come from levee failures and inundation from dam failure*
   - *Ranked as Occasional to Likely Occurrence for City.*
7. Hazardous Materials
   - *The City faces potential risks of hazardous materials incidents, both fixed site and transportation related.*
   - *However, low frequency of historical events.*
   - *Ground Transportation via highway and railway network*
8. Landslides
   - *Landslides and mudslides are caused by one or a combination of changes in slope of the terrain, increased load on the land, shocks and vibrations, changes in water content, groundwater movement, frost action, weathering, and changes in vegetation.*
   - *The greatest probability of occurrence is the wet months of November to March during or after major storms.*
   - *Ranked as Occasional Occurrence for City.*
9. Pandemics
   - *The nature and extent of this threat contains no significant documentation.*
10. Severe Winter Storms

[17] Federal Bureau of Investigation: Uniform Crime Rates. (2014). Retrieved November 10, 2016 from https://ucr.fbi.gov/crime-in-the-u.s/2014/crime-in-the-u.s.-2014/tables/table-8/table-8-by-state/Table_8_Offenses_Known_to_Law_Enforcement_by_California_by_City_2014.xls

- *Severe storms are an annual occurrence in Chico and normally occur in December to March. Storms produce heavy rain, hailstorm, lightning and strong winds.*
- *There are also periodic winter periods of freezing temperatures.*
- *Generally, low frequency of fatalities associated with severe storms.*
- *Ranked as Highly Likely Occurrence for City.*

11. Volcanic Eruptions
    - *The most proximate threat to the City is Mount Lassen (10,463 ft.) approximately 70 miles east of the City.*
    - *Mount Lassen last erupted in May 1915.*
    - *Ranked as Unlikely Occurrence for City.*

The overall hazard risk assessment for the City of Chico is provided below.

Figure 8: Hazard Risk Rating for City of Chico[18]

Table B.1. City of Chico Hazard Identification Table

Hazard	Geographic Extent	Probability of Future Occurrences	Magnitude/Severity	Significance
Dam Failure	Limited	Unlikely	Limited	Low
Drought & Water shortage	Limited	Likely	Limited	High
Earthquakes	Extensive	Occasional	Critical	Low
Earth Movements: Landslide	Limited	Occasional	Limited	Low
Earth Movements: Erosion	Limited	Unlikely	Limited	Low
Floods: 100/500 year	Significant	Occasional	Limited	Medium
Floods: Localized Stormwater	Significant	Likely	Limited	Medium
Hazardous Materials Incidents: Railroads	Limited	Likely	Limited	Low
Invasive Species: Pests/Plants	Significant	Likely	Limited	Medium
Levee Failure	Significant	Occasional	Limited	Medium
Marine Invasive Species	Limited	Unlikely	Limited	Low
Severe Weather: Extreme Heat	Limited	Likely	Limited	High
Severe Weather: Freeze and Winter Storm	Limited	Likely	Limited	High
Severe Weather: Heavy rain, hailstorm, lightning	Significant	Highly Likely	Limited	High
Severe Weather: Tornado	Limited	Occasional	Limited	Low
Severe Weather: Windstorms	Significant	Highly Likely	Limited	Medium
Volcanoes	Limited	Unlikely	Limited	Low
Wildfires	Significant	Highly likely	Critical	Medium

Geographic Extent
Limited: Less than 10% of planning area
Significant: 10-50% of planning area
Extensive: 50-100% of planning area

Probability of Future Occurrences
Highly Likely: Near 100% chance of occurrence in next year, or happens every year.
Likely: Between 10 and 100% chance of occurrence in next year, or has a recurrence interval of 10 years or less.
Occasional: Between 1 and 10% chance of occurrence in the next year, or has a recurrence interval of 11 to 100 years.
Unlikely: Less than 1% chance of occurrence in next 100 years, or has a recurrence interval of greater than every 100 years.

Magnitude/Severity
Catastrophic—More than 50 percent of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths
Critical—25-50 percent of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability
Limited—10-25 percent of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability
Negligible—Less than 10 percent of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid

Significance
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

Butte County (City of Chico)
Local Hazard Mitigation Plan Update
May 2013

Annex B.5

amec

[18] Ibid.

Transportation Risks

Aviation

Chico Municipal Airport is owned by the City and is located four miles North of Downtown Chico. The airport covers 1,475 acres, has two runways and one helipad. Scheduled passenger service ended in December 2014 and the airport only supports general aviation uses.[19] Aircraft operations, a figure that indicates the number of takeoffs and landings, averages 100 per day for the 12-month period ending December 31, 2015[20]. Cal Fire maintains an air-tanker base to support wildland fire suppression efforts in the area.

The airport is Indexed as Class III, Level A by the Federal Aviation Administration (FAA) which requires the airport to meet staffing and equipment criteria for Aircraft Rescue and Fire Fighting (ARFF) for air carrier commercial passenger operations. If scheduled passenger service were to return to Chico Municipal Airport, staffing and equipment at Fire Station 3 would need to comply with FAA – Part 139, Certification of Airports.[21]

The city and department administrations understand the changes necessary to update the Airport Certification Manual to ensure that the airport would maintain its certification in the event that the airport utilization or desired service levels change in the future.

Railroad

The principal rail transportation risk for the area centers on the trackage owned and operated by the Union Pacific Railroad (UP). A single mainline track through Chico serves as UP's main North-South rail line in Northern California connecting Sacramento, CA and Portland, OR following a path that generally parallels Highway 99 through Chico.

The freight cargoes are diverse and include coal, crude oil, LPG, grain and mixed cargoes originating from or destined to area seaports and beyond. The exact volume of hazardous materials rail shipments is elusive because of railroad security concerns. Based upon local observations of railroad freight activity, it appears that there is sufficient evidence that the hazardous nature and volume of these cargoes introduces some risk.

Amtrak operates regularly scheduled passenger service on the Coast Starlight route that has a stop in Downtown Chico.

In addition, the City staff and Council have received a confidential analysis of hazards by rail that includes the type and volume of hazardous materials transported through Chico.

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[19] Accessed online at https://en.wikipedia.org/wiki/Chico_Municipal_Airport
[20] Accessed online at FAA, Air Traffic Activity System at http://aspm.faa.gov/opsnet/sys/opsnet-server-x.asp
[21] Accessed online at FAA, Part 139, Certification of Airports at http://www.ecfr.gov/cgi-bin/retrieveECFR?gp=&SID=6752d88d14e795dbc93e3b1aa463db88&mc=true&n=pt14.3.139&r=PART&ty=HTML#sp14.3.139.a

Highway

Significant road structures, including highways and interstates, provide access for the population of Chico and Butte County. Therefore, the inherent risk of motor vehicle accidents, vehicle fires, and hazardous materials releases exist.

Population Density, Development, and Growth

Overall, the density for the CFD is of urban density as defined by the Commission on Fire Accreditation International (CFAI).[22] The Commission's definition is that suburban is for populations between 1,000 and 2,000 per square mile. The CFAI's definition for an urban density is an incorporated area with over 30,000 people and a population density over 2,000 people per square mile. The metropolitan threshold is over 3,000 people per square mile.[23] The Department has a population density of approximately 2,700 per square mile.

Recommended service levels for suburban populations is that the first due unit is capable of arriving within 6 minutes and 30 seconds travel time with a goal of 5 minutes.[24] Utilizing the CFAI's definitions, Chico is an Urban population density and itherefore recommendations for travel time performance is the same for both metropolitan and urban population densities with a baseline service of 5 minutes and 12 seconds travel time for the first arriving unit and a goal of 4 minutes.[25]

Overall, the aggregate current performance for the Department meets baseline recommendations for Urban and Suburban densities from the Commission on Fire Accreditation International (CFAI). An individual analysis of each fire station's performance is provided begins on page 90. A comparison table of the current performance and national recommendations is provided below.

Table 12: Comparison of Response Times by Agency to Best Practices and National Experience

Call Category	Average Travel Time	90th Percentile Travel Time	CFAI[26] 90th Percentile Urban Travel Time	CFAI[27] 90th Percentile Suburban Travel Time	CFAI[28] 90th Percentile Rural Travel Time	NFPA 1710[29] 90th Percentile Travel Time	USFA[30] 90th Percentile Turnout and Travel
Fire	3:42	6:00	5:12	6:30	13:00	4:00	10:59
EMS	3:18	5:06	5:12	6:30	13:00	4:00	10:59

[22] CFAI. (2009). Fire & Emergency Service Self-Assessment Manual, 8th (ed.). Chantilly, Virginia: Author. (p. 71)
[23] Ibid.
[24] Ibid.
[25] Ibid.
[26] CFAI. (2009). Fire & *emergency service self-assessment manual*, (8th ed.). Chantilly, Virginia: Author.
[27] Ibid.
[28] Ibid.
[29] National Fire Protection Association. (2016). NFPA 1710, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments*. Boston, MA: National Fire Protection Association.
[30] USFA. (August 2006). Structure fire response times: Topical fire research series, 5(7). Emmitsburg, Maryland: Author.

Projected Growth

The City of Chico is experiencing modest growth, primarily in lower density residential occupancies[31]. Estimates from the Association of Butte County Governments and the State of California Department of Finance suggest a range of growth from 1.2 – 2.0% annual increase in population for the City of Chico between May 2014 and July 2020[32].

The Department boundaries are not expected to change other than through mergers or regional consolidation efforts. From this perspective, increases in population density may only serve to eventually require a greater concentration of resources to meet the demand rather than expanding the distribution model. In other words, because the Department does not anticipate creating a larger geographic coverage area through annexations, the likely result of population growth could require additional resources within the existing distribution model rather than by expanding the number of stations.

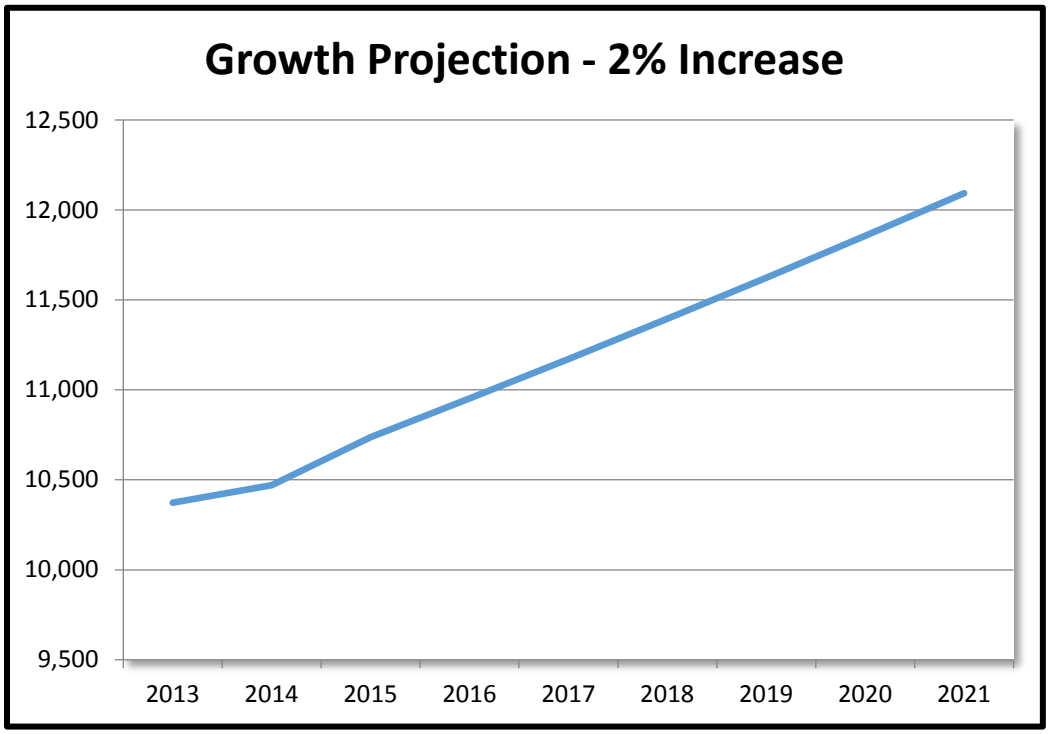
Three years of historical call volume were utilized to identify any general trends in community demands for service. Similar to many communities, the overall call volume is increasing at approximately 2% per year. The increasing call volume equates to approximately one additional call every two days over two years. In other words, from 2013 to 2015 the total call volume increased by 3.46%, or 365 calls.

Utilizing a constant approximate growth of 2%, projections indicate that the Department's total call volume will increase to over 12,000 calls per year by 2021. This assumes no changes in deployment models and response. While the current model is stable and sustainable into the future, if the trend continues, the Department may have to reinvest or reallocate resources to meet the growing demand in the distant future. The current model is stable and sustainable into the future. A graphic representation of the historical and projected growth at a constant 2% per year is provided below.

Finally, in 2018 a planned annexation of the Chapman/Mulberry neighborhood will occur increasing the population by approximately 1,332 and include 138 acres and 559 housing units. The department should have sufficient capacity to absorb the responsibilities within the annexed area.

[31] City of Chico, 2014-2022 Housing Element retrieved online at http://www.hcd.ca.gov/housing-policy-development/housing-resource-center/plan/he/housing-element-documents/chico_5th_adopted062714.pdf
[32] Butte County Long-Term Regional Forecasts 2014-2040, Association of Butte County Association of Governments, retrieved online at http://www.bcag.org/documents/demographics/pop_emp_projections/Growth_Forecasts_2014-2040_draft.pdf

Figure 9: Historical and Projected Growth in Total Call Volume



Risk Assessment

Fire Suppression Services

The CFD provides services for the suppression of fires using a minimum of six fire stations, four fire engines fully equipped with water supply, hoses, portable ladders, and various tools such as axes. In addition, a dedicated ladder truck is deployed for operating at incidents where elevated fire streams and rescuing trapped victims from upper floors is needed. There is one Division Chief assigned each day that provides command and control activities at significant fires. Finally, the Department provides response capabilities and personnel for wildland fire risks.

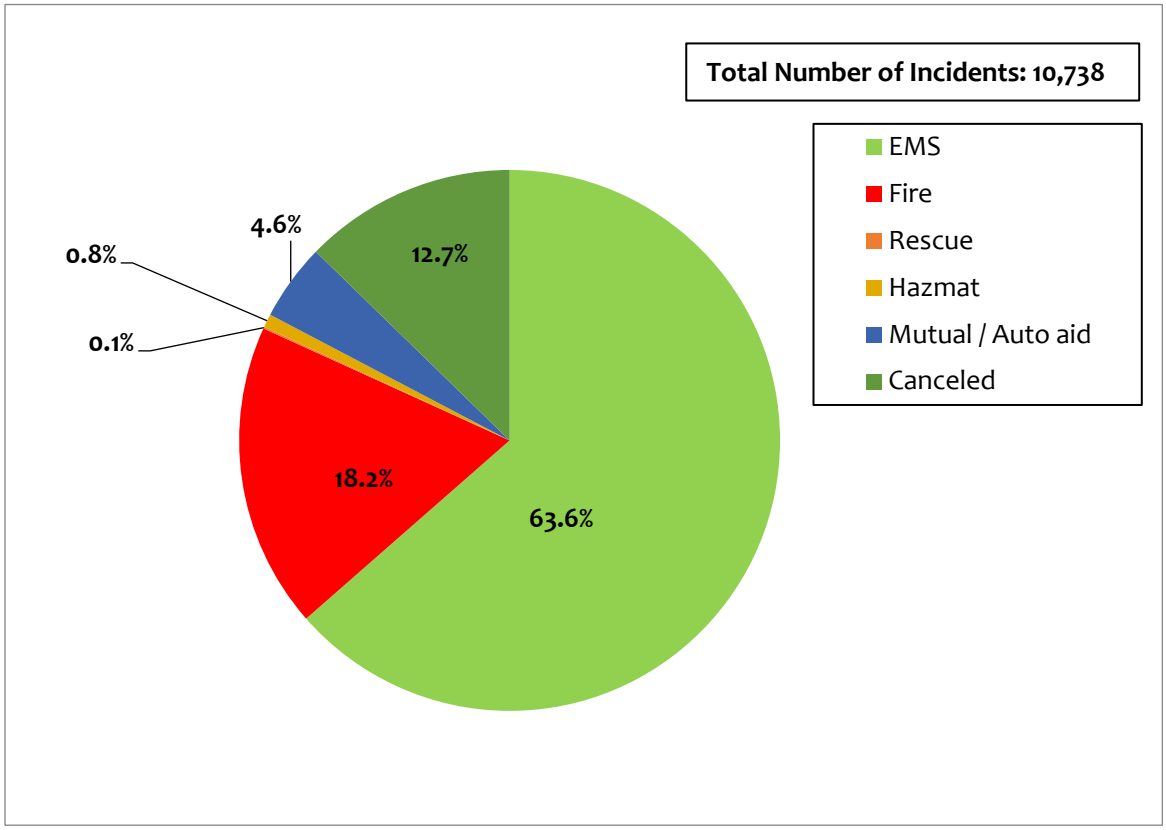
Community Service Demands - Fire

In 2015, the Department responded to a total of 10,738 requests for service, or dispatches. The number of fire related calls were 1,959, which accounted for 18.2% of the dispatched incidents. The number of individual unit responses will be more reflective of total department workload since 14% of the Department's responses include more than one unit. The tables and figures below summarize the Department's responses.

Table 13: Number of Incidents Dispatched by Category – 2015

Call Category	Number of Calls	Calls per Day	Call Percentage
Cardiac and stroke	590	1.6	5.5%
Seizure and unconsciousness	894	2.4	8.3%
Breathing difficulty	653	1.8	6.1%
Overdose and psychiatric	376	1.0	3.5%
MVA	601	1.6	5.6%
Fall and injury	1,032	2.8	9.6%
Illness and other	2,678	7.3	24.9%
EMS Total	**6,824**	**18.7**	**63.6%**
Structure fire	92	0.3	0.9%
Outside fire	268	0.7	2.5%
Vehicle fire	26	0.1	0.2%
False alarm	436	1.2	4.1%
Good intent	98	0.3	0.9%
Public service	727	2.0	6.8%
Fire other	312	0.9	2.9%
Fire Total	**1,959**	**5.4**	**18.2%**
Rescue	**11**	**0.0**	**0.1%**
Hazmat	**86**	**0.2**	**0.8%**
Mutual/Auto Aid	**493**	**1.4**	**4.6%**
Canceled	**1,365**	**3.7**	**12.7%**
Total	**10,738**	**29.4**	**100.0%**

Figure 10: Percentage of Total Incidents Dispatched by Category

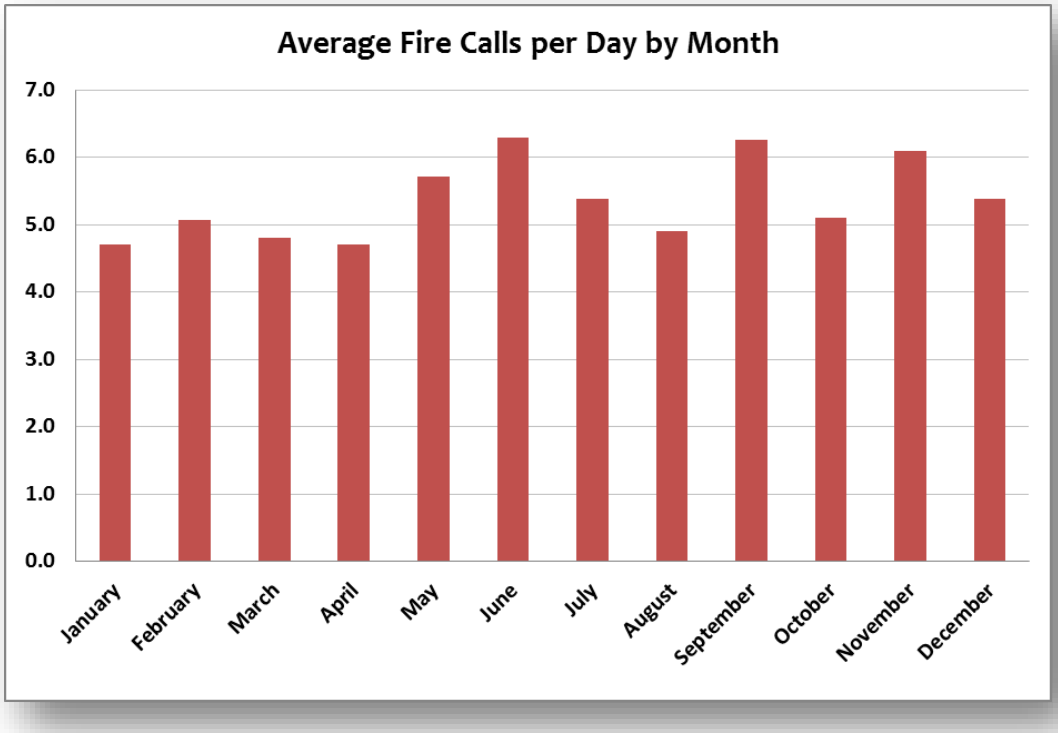


Temporal analyses were conducted to evaluate patterns in community demands for fire related services. These measures examined the frequency of requests for service in the 2015 calendar year by month, day of week, and hour of day. Results found that there was variability by month. The three months with most fire calls in order were: June (6.3 per day), September (6.3 per day), and November (6.1 per day). The three months with least fire calls in order were: April (4.7 per day), January (4.7 per day), and March (4.8 per day). Results are presented below.

Table 14: Total Fire Related Calls per Month of Fiscal Year 2015

Month	Number of Calls	Calls per Day	Call Percentage
January	146	4.7	7.5
February	142	5.1	7.2
March	149	4.8	7.6
April	141	4.7	7.2
May	177	5.7	9.0
June	189	6.3	9.6
July	167	5.4	8.5
August	152	4.9	7.8
September	188	6.3	9.6
October	158	5.1	8.1
November	183	6.1	9.3
December	167	5.4	8.5
Total	**1,959**	**5.4**	**100.0**

Figure 11: Average Fire Related Calls per Month of Fiscal Year 2015

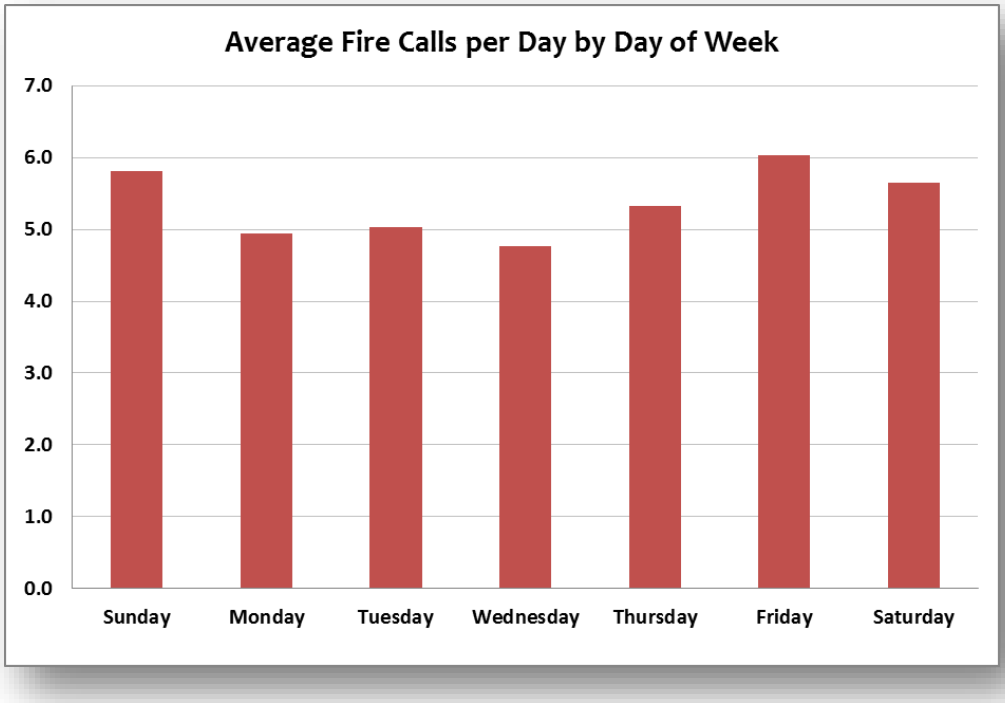


Similar analyses were conducted for fire related calls per day of week. The data revealed that there is little variability in the demand for services by day of week. Wednesday was the lowest for the week, averaging 4.8 per day or 12.7 percent of the fire related calls for the week. Friday has the highest frequency of requests for fire related services averaging 6.0 calls per day and 16.0%. Results for this analysis are presented below.

Table 15: Total Fire Related Calls by Day of Week for Fiscal Year 2015

Day of Week	Number of Calls	Calls per Day	Call Percentage
Sunday	302	5.8	15.4
Monday	257	4.9	13.1
Tuesday	262	5.0	13.4
Wednesday	248	4.8	12.7
Thursday	282	5.3	14.4
Friday	314	6.0	16.0
Saturday	294	5.7	15.0
Total	**1,959**	**5.4**	**100.0**

Figure 12: Average Fire Related Calls by Day of Week for Fiscal Year 2015



Fire related calls were evaluated by hour of the day. Some variability exists in the time of day that requests for fire related services are received. The hours that include midnight to 0600 have the lowest demands. While the middle of the day has the greatest frequency of calls, specifically the 13-hour period from 0900 through 2200 are above 145 calls in a year. The average number of calls per hour in a year is 132. The data illustrates that the busiest times of the day for fire related incidents are

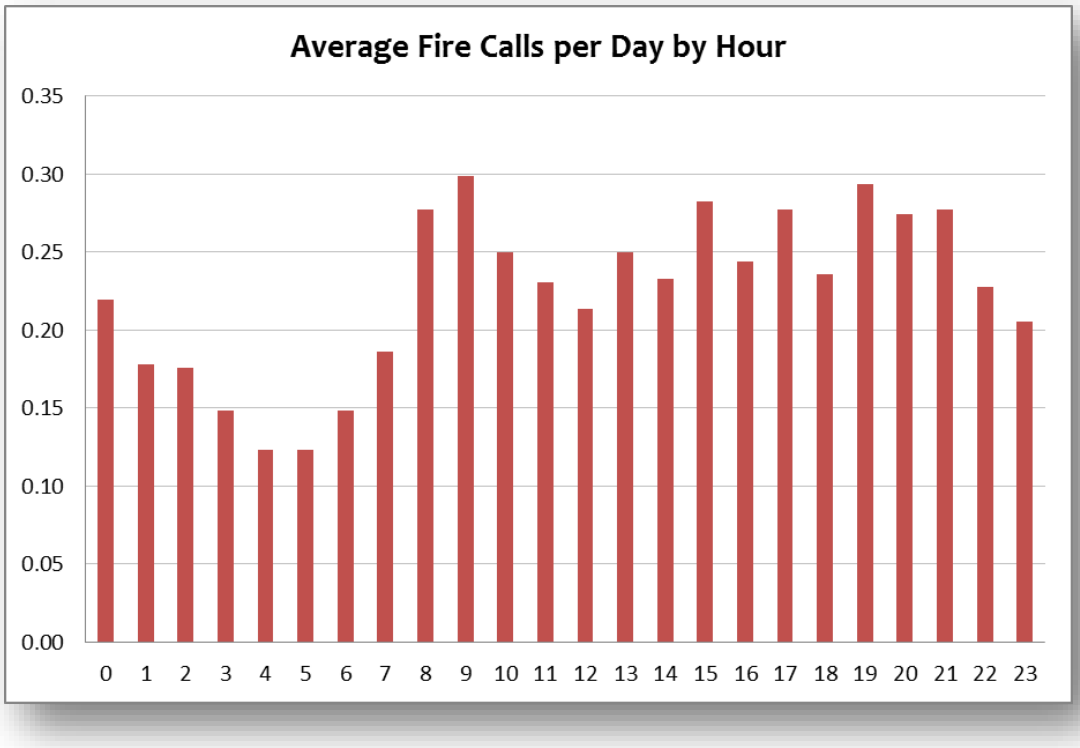
between 0800 and 2100. The seven hours at 0800, 0900, 1500, 1700, 1900, 2000 and 2100 had more than 100 calls in a year. In the seven-hour period from 0100 to 0700, a total of 395 calls occurred in a year, which averaged 1.1 calls per day.

Finally, to provide a more granular understanding of the community's demand for fire related services, this temporal analysis included the average number of calls per hour. In other words, when referring to the figure below, the busiest hour is at 0900 with 109 calls during that hour in 2015. The average number of calls per hour is a daily average for those 109 calls if they were equally distributed. Therefore, the busiest hour per day would be at 0900 with an average hourly call volume of less than 1 at 0.30 calls per hour. Below are the results:

Table 16: Total and Average Fire Related Calls by Hour of Day for Fiscal Year 2015

Hour of Day	Number of Calls	Calls per Hour	Call Percentage
0	80	0.22	4.1
1	65	0.18	3.3
2	64	0.18	3.3
3	54	0.15	2.8
4	45	0.12	2.3
5	45	0.12	2.3
6	54	0.15	2.8
7	68	0.19	3.5
8	101	0.28	5.2
9	109	0.30	5.6
10	91	0.25	4.6
11	84	0.23	4.3
12	78	0.21	4.0
13	91	0.25	4.6
14	85	0.23	4.3
15	103	0.28	5.3
16	89	0.24	4.5
17	101	0.28	5.2
18	86	0.24	4.4
19	107	0.29	5.5
20	100	0.27	5.1
21	101	0.28	5.2
22	83	0.23	4.2
23	75	0.21	3.8
Total	**1,959**	**5.37**	**100.0**

Figure 13: Average Fire Related Calls per Day by Hour of Day in Fiscal Year 2015



For these analyses, "Fire Related" incidents are an aggregated category of the various final incident types available in the NFIRS databases. Public service was the most frequent community demand (averaging at 2.0 requests per day), followed by false alarm (averaging at 1.2 requests per day). Responses to structure, outside, vehicle and marine fires totaled 386 (averaging about 1.1 per day), and outside fire is the largest category of the three. Of the 140 fire incidents, which were missing NFIRS reports, 104 were airport runway check incidents, mostly responded by the crash rescue in Station 3. The NFIRS final incident types included in "Fire" dispatches with the corresponding number of calls and their percentages are provided below.

Table 17: Fire Related Final NFIRS Incident Types

NFIRS Incident Type	Number of Calls	Percentage of Total Fire Service Demands
100 - Fire, other	118	6.0
111 - Building fire	39	2.0
112 - Fires in structure other than in a building	3	0.2
113 - Cooking fire, confined to container	35	1.8
114 - Chimney or flue fire, confined to chimney or flue	2	0.1
116 - Fuel burner/boiler malfunction, fire confined	1	0.1
118 - Trash or rubbish fire, contained	7	0.4
120 - Fire in mobile prop. used as a fixed struc., other	2	0.1
122 - Fire in motor home, camper, recreational vehicle	1	0.1
123 - Fire in portable building, fixed location	1	0.1
130 - Mobile property (vehicle) fire, other	2	0.1
131 - Passenger vehicle fire	20	1.0
132 - Road freight or transport vehicle fire	1	0.1
136 - Self-propelled motor home or recreational vehicle	1	0.1
137 - Camper or recreational vehicle (RV) fire	1	0.1
140 - Natural vegetation fire, other	18	0.9
141 - Forest, woods or wildland fire	4	0.2
142 - Brush or brush-and-grass mixture fire	7	0.4
143 - Grass fire	15	0.8
150 - Outside rubbish fire, other	17	0.9
151 - Outside rubbish, trash or waste fire	19	1.0
154 - Dumpster or other outside trash receptacle fire	54	2.8
155 - Outside stationary compactor/compacted trash fire	1	0.1
160 - Special outside fire, other	10	0.5
161 - Outside storage fire	1	0.1
162 - Outside equipment fire	3	0.2
173 - Cultivated trees or nursery stock fire	1	0.1
200 - Overpressure rupture, explosion, overheat other	3	0.2
210 - Overpressure rupture from steam, other	1	0.1
240 - Explosion (no fire), other	2	0.1
243 - Fireworks explosion (no fire)	5	0.3
251 - Excessive heat, scorch burns with no ignition	24	1.2
400 - Hazardous condition, other	43	2.2
430 - Radioactive condition, other	1	0.1
440 - Electrical wiring/equipment problem, other	28	1.4
441 - Heat from short circuit (wiring), defective/worn	2	0.1
442 - Overheated motor	2	0.1
443 - Breakdown of light ballast	2	0.1
444 - Power line down	46	2.3
445 - Arcing, shorted electrical equipment	22	1.1
460 - Accident, potential accident, other	10	0.5
462 - Aircraft standby	4	0.2
4620 - Aircraft Standby Other	1	0.1
4623 - Engine Malfunction	2	0.1
4628 - Smoke/Fumes in Aircraft	1	0.1
463 - Vehicle accident, general cleanup	15	0.8
480 - Attempted burning, illegal action, other	9	0.5
481 - Attempt to burn	4	0.2
500 - Service Call, other	28	1.4
510 - Person in distress, other	42	2.1
511 - Lock-out	18	0.9
512 - Ring or jewelry removal	1	0.1
520 - Water problem, other	29	1.5

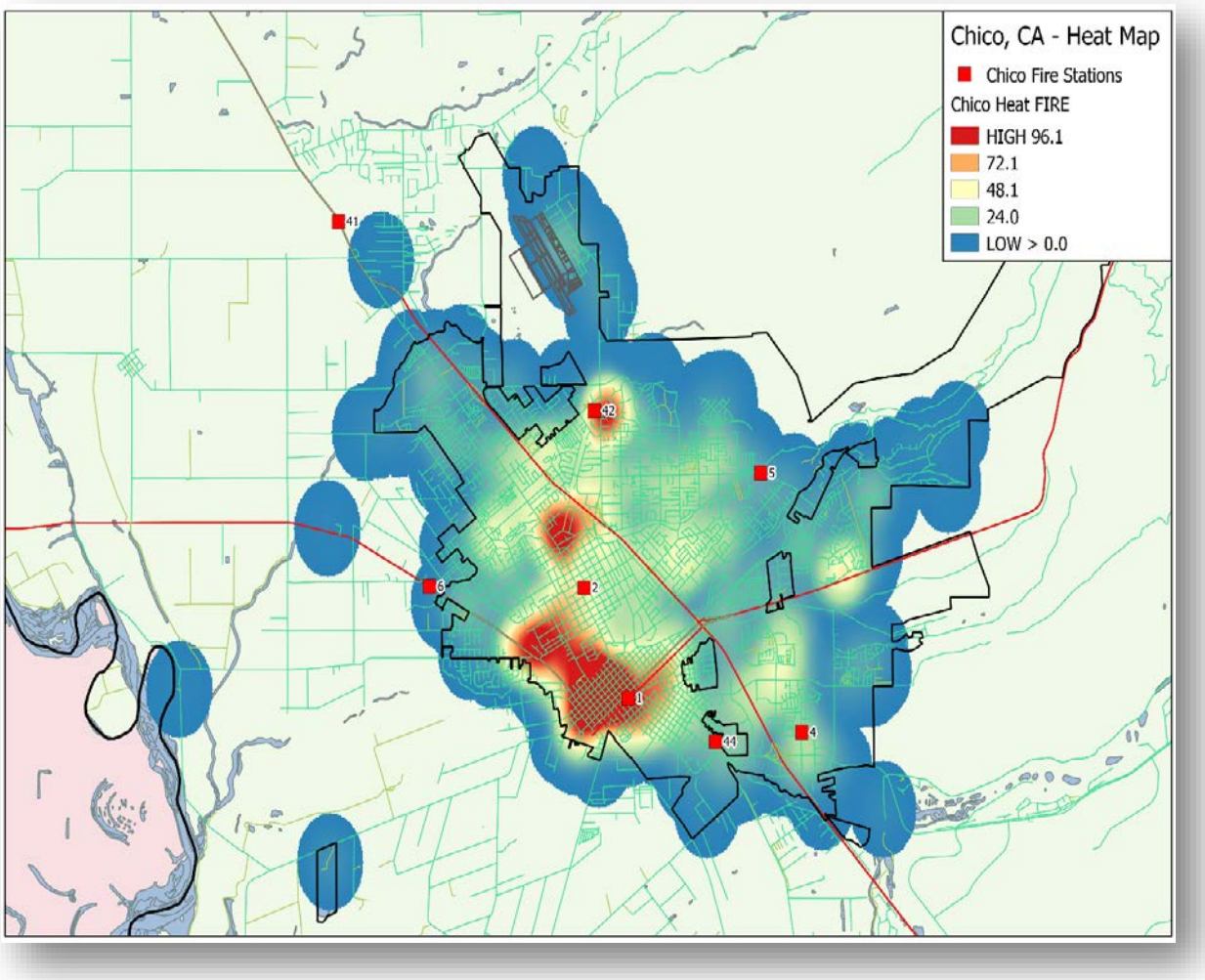
NFIRS Incident Type	Number of Calls	Percentage of Total Fire Service Demands
521 - Water evacuation	2	0.1
522 - Water or steam leak	29	1.5
531 - Smoke or odor removal	15	0.8
540 - Animal problem, other	1	0.1
541 - Animal problem	1	0.1
542 - Animal rescue	9	0.5
550 - Public service assistance, other	99	5.1
551 - Assist police or other governmental agency	36	1.8
552 - Police matter	31	1.6
553 - Public service	96	4.9
554 - Assist invalid	164	8.4
555 - Defective elevator, no occupants	5	0.3
561 - Unauthorized burning	61	3.1
600 - Good intent call, other	44	2.2
631 - Authorized controlled burning	8	0.4
650 - Steam, other gas mistaken for smoke, other	4	0.2
651 - Smoke scare, odor of smoke	28	1.4
652 - Steam, vapor, fog or dust thought to be smoke	2	0.1
653 - Smoke from barbecue, tar kettle	8	0.4
671 - HazMat release investigation w/no HazMat	4	0.2
700 - False alarm or false call, other	98	5.0
710 - Malicious, mischievous false call, other	8	0.4
711 - Municipal alarm system, malicious false alarm	3	0.2
714 - Central station, malicious false alarm	2	0.1
715 - Local alarm system, malicious false alarm	6	0.3
721 - Bomb scare - no bomb	5	0.3
730 - System malfunction, other	22	1.1
731 - Sprinkler activation due to malfunction	1	0.1
733 - Smoke detector activation due to malfunction	51	2.6
734 - Heat detector activation due to malfunction	7	0.4
735 - Alarm system sounded due to malfunction	20	1.0
736 - CO detector activation due to malfunction	29	1.5
740 - Unintentional transmission of alarm, other	17	0.9
741 - Sprinkler activation, no fire – unintentional	2	0.1
742 - Extinguishing system activation	1	0.1
743 - Smoke detector activation, no fire - unintentional	112	5.7
744 - Detector activation, no fire – unintentional	15	0.8
745 - Alarm system activation, no fire – unintentional	33	1.7
746 - Carbon monoxide detector activation, no CO	4	0.2
800 - Severe weather or natural disaster, other	4	0.2
900 - Special type of incident, other	1	0.1
911 - Citizen complaint	2	0.1

With respect to the fire related community demands, actual structure fires account for approximately 4.7% of the fire related incidents. While it is no less important to prepare for the risk of fires, the frequency of need for these traditional services are in decline.

A geospatial analysis was conducted utilizing the community's historical service demand for fire related incidents in Fiscal Year 2015. These are for all fire related incidents and not specifically any sub-determinant of fire risk. This analysis is provided below.

It is evident that the Department's fire related historical risks are concentrated most heavily in the Southwest portions of the City, in the Downtown areas surrounding Chico State University, served primarily by Stations 1 and 2. There is a second area of high concentration in the northeast portion of the City, near Butte County Fire Station 42. The remaining fire related incidents are generally distributed throughout the center core of the City with the least frequent events at the perimeter. When referring to the figure below, the higher the frequency of events, the darker the red color. Specifically, the higher concentrations of fire related incidents are in station demand zones of 1, 2 and 42. Station demand zones 3 and 6 had the lowest incident frequency of fire related incidents.

Figure 14: Fire Related Incidents – Fiscal Year 2015



Community Risks - Fire

Occupancy risk was evaluated across the jurisdiction utilizing the most recent ISO batch report as well as internal data provided by the department for risks associated with the Butte College.

Chico has unique fire risks related to college student populations, especially with off campus housing. Nationally, from January 2000 to May 2015, there were 85 fatal fires in dormitories, fraternities, sororities and off-campus housing, resulting in 118 fatalities, an average of approximately seven per school year.[33] 94 percent of fatal fires occur in off campus housing. CFD has experienced student-housing fires and has taken active steps to reduce this risk, most recently by banning combustible furniture on porches.

The risk matrices utilized and develop with the Chico fire staff is presented here. The risk matrix utilized with the ISO data evaluated Fire Flow, Height, Square Footage, the presence of a basement, and the presence of a sprinkler system, construction class, and building combustion class. The college data was not as robust but was appropriately evaluated utilizing height, square footage, the presence of a sprinkler system, and the construction class. The risk matrices are provided below.

[33] US Fire Administration, Campus fire safety outreach, retrieved at https://www.usfa.fema.gov/prevention/outreach/college.html

Table 18: Summary of Risk Matrix

Risk Class	Fire Flow		Number of Stories		Square Footage		Basement Present (Yes/No)	Full Credit Sprinkler System (Yes/No)	Construction Class		Building Combustion Class		Total Risk Score
	Value	Scale	Value	Scale	Value	Scale			Value	Scale	Value	Scale	Scale
High	3	≥ 1500 gpm	5	≥ 4	5	>=100k GPM	5/o	-10/o	5	Combustible or Frame	5	Quick Free and Rapid Burning	≥ 18
Moderate	2	> 499 and < 1500 gpm	3	> 1 and < 4	3	> 10k gpm < 100k GPM	5/o	-10/o	3	Joisted Masonry	3	Combustible	>8 and <18
Low	1	≤ 499 gpm	1	1	1	< 10k GPM	5/o	-10/o	1	Non-Combustible, Masonry Non-Combustible, Fire Resistive	1	Slow Non/Limited Combustible	≤ 8

Table 19: Occupancy Level Risk Matrix – Chico State University - Chico

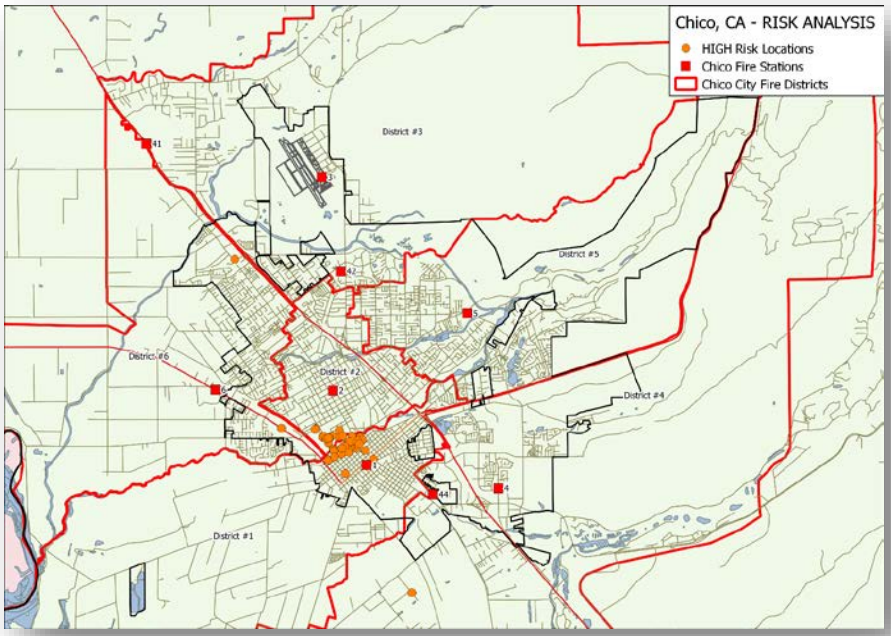
Risk Class	Number of Stories		Square Footage		Full Credit Sprinkler System (Yes/No)	Construction Class		Total Risk Score
	Value	Scale	Value	Scale	Value	Value	Scale	Scale
High	5	≥ 4	5	>=100k GPM	-5/0	5	Combustible or Frame	≥ 10
Moderate	3	> 1 and < 4	3	> 10k gpm < 100k GPM	-5/0	3	Joisted Masonry	>3 and <10
Low	1	1	1	< 10k GPM	-5/0	1	Non-Combustible, Masonry Non-Combustible, Fire Resistive	≤ 3

Due to the relatively higher demands for personnel and apparatus required for fire events that have a large square footage, higher elevation (stories), and specific types of occupancy and construction risks garnished the highest numeric values. Conversely, the presence of a fire alarm and/or an automatic sprinkler system elicited a negative numeric value. In this manner, the fact that 96% of the fires are controlled with sprinkler activation is included into the matrix for a more realistic risk factor rating. Over 1,300 occupancies were analyzed and rated as high, moderate, or low risk. In total, there were 70 occupancies rated as high risk, 831 as moderate, and 400 rated as low risk. Geospatial analyses were completed to map the locations of each of the commercial occupancies included in the risk matrix process and specifically overlaid within each of the fire station locations.

Other fire related risks that were evaluated were mobile/transportation risks, wildland risks, and single/multi-family residential fire risks. The mobile/transportation and wildland risks were previously presented in the community risk profile. The single/multi-family residence structures are correlated with the population densities previously presented. Finally, the residential fire risk was categorized as low/moderate severity. Therefore, the Department's preparedness for their highest risks necessitates that the department is well resourced for the lower risks of similar expertise, personnel, and apparatus.

When reviewing the output for high-risk occupancies, it is clear that the prospective risk is concentrated between Station 1 and Station 2 following a similar pattern as the historical demand for services previously presented. From a broad perspective, this provides validation to the risk assessment process developed with the Department as well as the necessary deployment strategy to cover the historical demand for services. The results of the geospatial analyses of high, moderate, and low risk structures are presented in the figures below.

Figure 15: High Risk Occupancies by Station Demand Zone



Moderate and low risk occupancies are more evenly distributed across the community and are more easily handled by the typical mitigation strategies and resource allocation while the high-risk occupancies require a higher concentration of personnel.

Figure 16: Moderate Risk Occupancies by Station Demand Zone

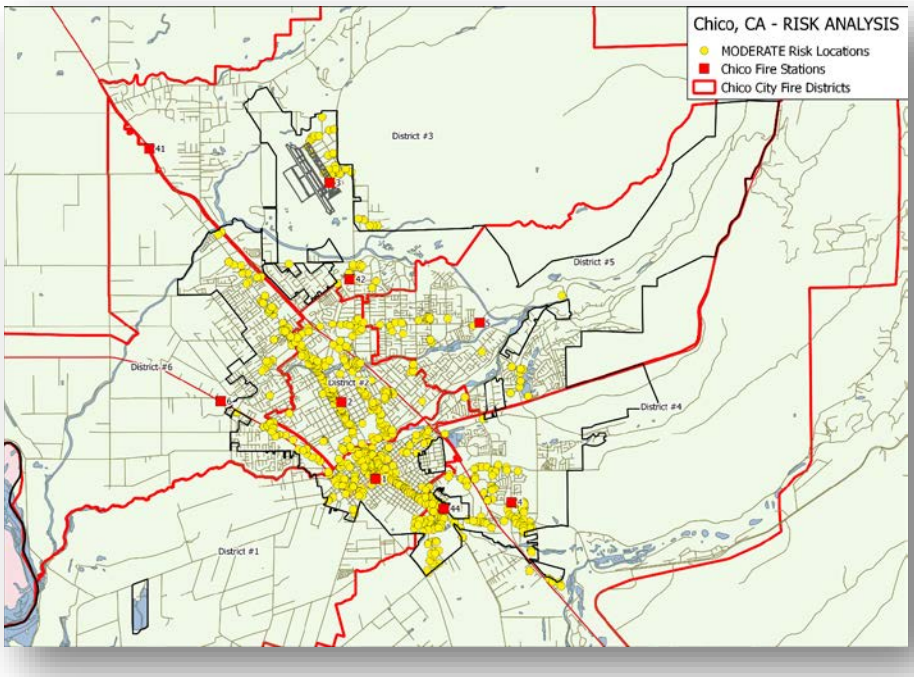
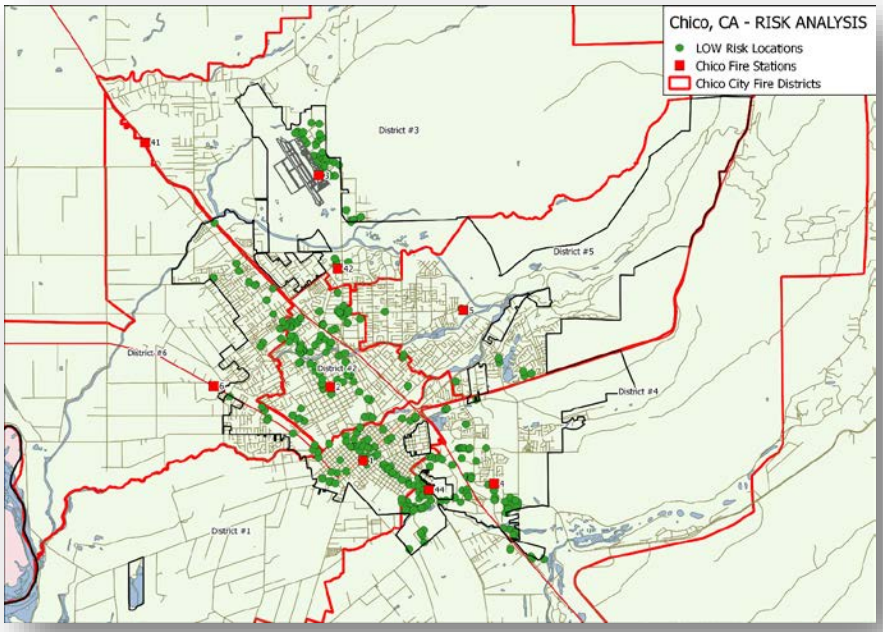


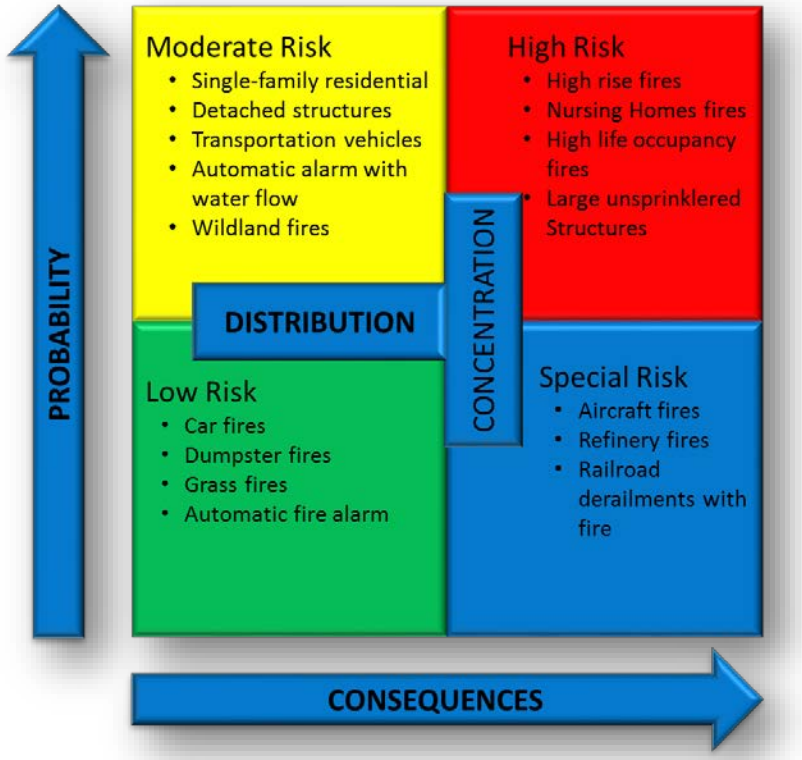
Figure 17: Low Risk Occupancies by Station Demand Zone



Probability/Consequence of Fire Event Risk

The relatively low frequency of fire related events required the Department to rely more heavily on the consequences of the events than the probability of the event occurring. For example, according to the Department's NFIRS final incident typing, the department responded to 80 structure fires or fires in buildings involving cooking or chimneys. The resulting probability and consequence matrix is presented below.

Figure 18: Probability and Consequence Matrix for Fire Risk



Critical Task Analysis

The critical tasks were developed through a collaborative effort with the Department's staff. Critical tasks were developed for low, moderate, and high-risk fire events. Low risk events that single engines responses would typically handle such as vehicle fires, dumpster fires, and residential automatic fire alarms. Moderate risk responses require additional resources to mitigate the event effectively and efficiently such as a 1 to 2 story residential structure. High-risk events required considerable resources to effectively and efficiently mitigate the events such as high occupancy or unprotected structures. For example, a significant risk in Chico exists in multi-story Victorian homes that are unprotected and have high single room occupancies with a higher risk college population. In addition to the critical tasks for personnel requirements, a similar process was conducted to establish the appropriate apparatus required to assemble the requisite personnel and equipment. The figures below provide the critical task development.

Critical tasks are best defined as the initial activities that must be accomplished to begin operations in a safe and effective manner and have the best opportunity to impact the ultimate outcome. The critical tasks are not the total of personnel needed on incidents, but rather the minimum number needed for initial actions. It is for this reason, that the department response to each incident type and level is greater than the critical tasks identified.

Table 20: Critical Tasks for Structure Fire – Low / Moderate Risk - Possible

Critical Task	Needed Personnel
Command / Control	1
Investigation	2
2-In-2-Out	2
Total	**5**

Table 21: Apparatus and Personnel Requirements for Low / Moderate Risk - Possible

Responding Units	Minimum Staffing
Engine	3
Engine or Truck	3 (4)
Division Chief	1
Total Response Provided	**7 (8)**
Personnel Required by Critical Tasks	**5**

Table 22: Critical Tasks for Confirmed Structure Fire – Moderate Risks

Critical Task	Needed Personnel
Command / Control	1
Pump Operator	1
Fire Attack	2
Water Supply	2
Primary Search	2
Ventilation	2
Rapid Intervention Crew (RIC)	3
Total	**13**

Table 23: Apparatus and Personnel Requirements for Moderate Risk - Structure Fire

Responding Units	Minimum Staffing
Engine	3
Engine	3
Engine	3
Engine	3
Truck	4
Division Chief	1
Medical (Private Ambulance)	2
Total Response Provided	**15-19**
Personnel Required by Critical Tasks	**13**

Table 24: Critical Tasks for High Risk - Structure Fire

Critical Task	Needed Personnel
Incident Command	1
Fire Attack	4
Water Supply	2
Pump Operator	1
Search	4
Ventilation	4
RIC	3
Aerial Operations	2
Medical (Private Ambulance)	2
Safety	1
Total	**24**

Table 25: Apparatus and Personnel Requirements for High Risk - Structure Fire

Responding Units	Minimum Staffing
Engine	3
Engine	3
Engine	3
Engine	3
Truck	4
Division Chief	1
Safety Officer	1
Engine (County)	2
Engine (County)	2
Engine (County)	2
Ambulance (private)	2
Total Response Provided	**26**
Personnel Required by Critical Tasks	**24**

Table 26: Critical Tasks for Low/Moderate Risk - Fire Alarms

Critical Task	Needed Personnel
Investigation	3
Total	**3**

Table 27: Apparatus and Personnel Requirements for Low/Moderate Risk - Fire Alarms

Responding Units	Minimum Staffing
Engine	3
Total Response Provided	**3**
Personnel Required by Critical Tasks	**3**

Table 28: Critical Tasks for Commercial Fire Alarms

Critical Task	Needed Personnel
Investigation	3
Total	**3**

Table 29: Apparatus and Personnel Requirements for Commercial Fire Alarms

Responding Units	Minimum Staffing
Engine /Truck	3 (4)
Total Response Provided	**3 (4)**
Personnel Required by Critical Tasks	**3**

Emergency Medical Services

The CFD provides Basic Life Support (BLS) emergency medical services (EMS) with automated external defibrillator (AED) certification. All Department personnel are Emergency Medical Technicians (EMTs) providing first responder service from fire engines, the squad and ladder truck. Butte County Emergency Medical Service provides, BLS, Advanced Life Support (ALS) and ambulance transportation services through an exclusive contract with First Responder EMS, LLC.

The City's 9-1-1 emergency communications center and primary public safety answering point (PSAP) obtains basic medical information and routes the call to Butte County EMS for ambulance dispatching and pre-arrival instructions. Requests for EMS are categorized as either BLS or ALS.

All EMS requests receive one of the Department's first responder units. Most BLS patients are either treated and released or treated and transported by the Butte County Ambulance. ALS patients are treated and released or treated and transported by Butte County Ambulance. In total, the department wholly participates in the delivery of EMS and, at full staffing, has seven (7) fire suppression units geographically deployed to meet the service demands and the Department's current performance goals. Finally, the Department participates in mutual and automatic aid agreements with the surrounding municipalities and fire Departments.

Community Service Demands

The majority of the community's requests for services are for emergency medical services. In total, approximately 64% of all Department requests for services are for EMS. A summary of all dispatched calls in calendar year 2015 is provided again below.

Table 30: Number of Incidents Dispatched by Category – Calendar Year 2015

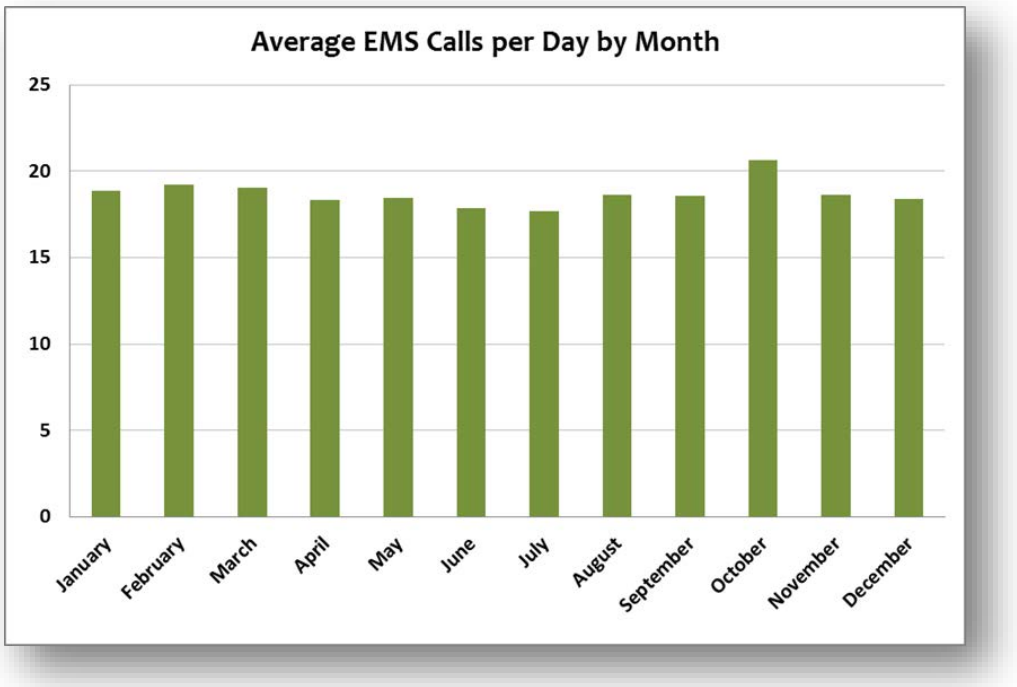
Call Category	Number of Calls	Calls per Day	Call Percentage
EMS	6,824	18.7	63.6
Fire	1,959	5.4	18.2
Rescue	11	0.0	0.1
Haz Mat	86	0.2	0.8
Mutual/Auto Aid	493	1.4	4.6
Cancelled	1,365	3.7	12.7
Total	**10,738**	**29.4**	**100.0**

Temporal analyses were completed to describe the community's demands for emergency medical services. These analyses were completed by month of year, day of week, and hour of day. There is minor variability between months of the year with October (20.6 EMS requests per day) receiving the most requests for service and July (17.7 EMS requests per day) the least. Results are presented in tabular form below.

Table 31: Annual Total and Average per Day of EMS Calls by Month of Year

Month	Number of Calls	Calls per Day	Call Percentage
January	586	18.9	8.6
February	538	19.2	7.9
March	590	19.0	8.6
April	550	18.3	8.1
May	572	18.5	8.4
June	536	17.9	7.9
July	548	17.7	8.0
August	577	18.6	8.5
September	557	18.6	8.2
October	640	20.6	9.4
November	559	18.6	8.2
December	571	18.4	8.4
Total	**6,824**	**18.7**	**100.0**

Figure 19: Average EMS Calls per Day by Month of Year

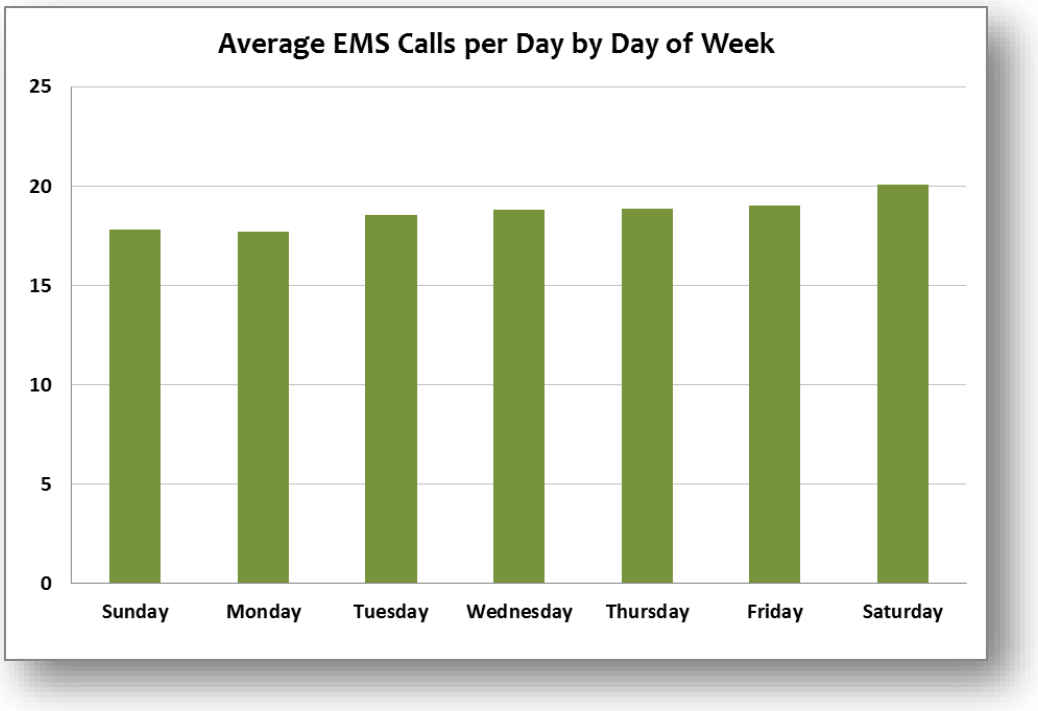


Similar analyses were conducted examining the frequency of requests for service by the day of the week. Once again, there is only minor variability in the demand for services by the day of the week. Saturday receives the most requests for service and Monday the least. Results are provided below.

Table 32: Annual Total and Average per Day of EMS Calls by Day of Week

Day of Week	Number of Calls	Calls per Day	Call Percentage
Sunday	927	17.8	13.6
Monday	922	17.7	13.5
Tuesday	964	18.5	14.1
Wednesday	979	18.8	14.3
Thursday	999	18.8	14.6
Friday	989	19.0	14.5
Saturday	1,044	20.1	15.3
Total	**6,824**	**18.7**	**100.0**

Figure 20: Average EMS Calls per Day by Day of Week

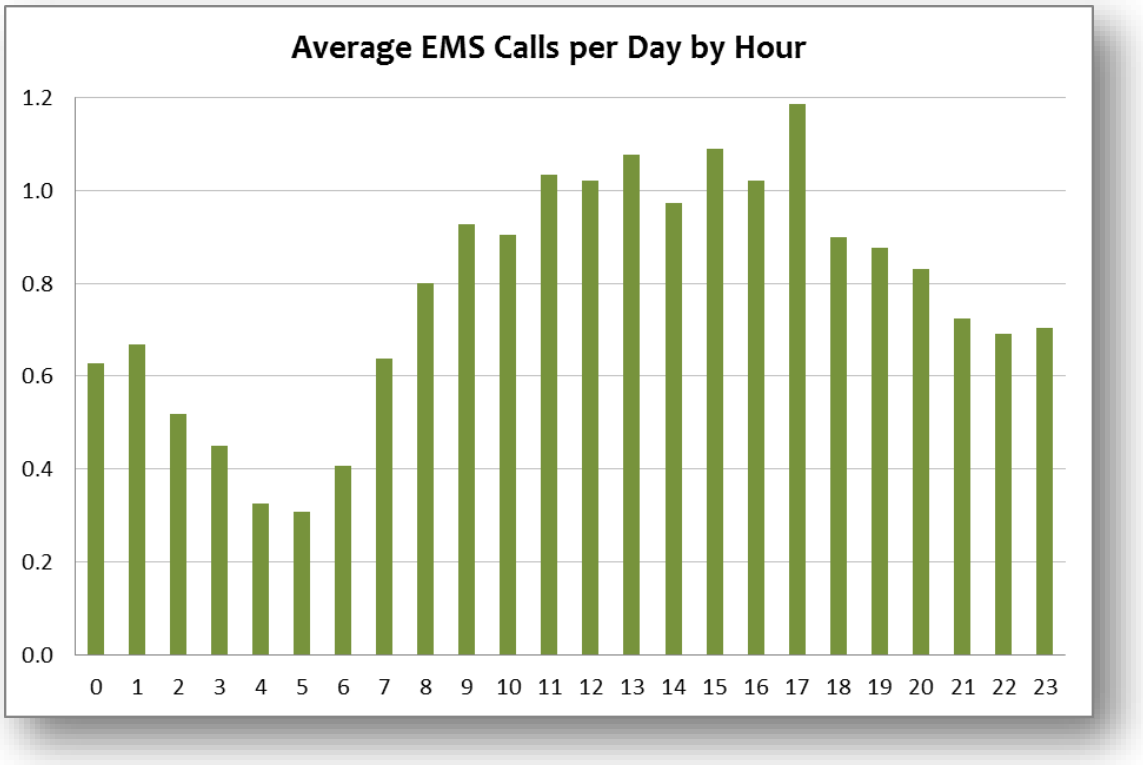


Finally, the analyses for EMS services are concluded by identifying the EMS calls by hour of day and the average hourly rate of EMS calls per hour. The demand curve for requests for EMS service follows an expected pattern experienced in similar communities across the nation. The higher frequency of service calls begins from 0900 to 2000 and each hour had more than 300 calls. The demand peaked at 1700 with 433 calls in a year. The average hourly rate of service requests is 0.78 for any hour during the day with the peak occurring at 1700 at 1.2 calls on average during the hour, and a low at 0500 of 0.31 calls on average during that hour. Results are provided below.

Table 33: Annual Total and Average per Day of EMS Calls by Hour of Day

Hour of Day	Number of Calls	Calls per Hour	Call Percentage
0	229	0.63	3.4
1	244	0.67	3.6
2	189	0.52	2.8
3	164	0.45	2.4
4	119	0.33	1.7
5	112	0.31	1.6
6	148	0.41	2.2
7	233	0.64	3.4
8	292	0.80	4.3
9	338	0.93	5.0
10	330	0.90	4.8
11	377	1.03	5.5
12	373	1.02	5.5
13	393	1.08	5.8
14	355	0.97	5.2
15	398	1.09	5.8
16	373	1.02	5.5
17	433	1.19	6.3
18	328	0.90	4.8
19	320	0.88	4.7
20	303	0.83	4.4
21	264	0.72	3.9
22	252	0.69	3.7
23	257	0.70	3.8
Total	**6,824**	**18.70**	**100.0**

Figure 21: Average EMS Calls per Day by Hour of Day



For these analyses, EMS incidents are an aggregated category of the various granular EMS requests categorized based upon CAD call description. EMS requests accounted for 63.6% of the total requests and averaged 18.7 requests per day. Illness and other was the most frequent community demand (averaging 7.3 requests per day), followed by fall and injury (averaging 2.8 requests per day). Cardiac and stroke requests totaled 590, averaging 1.6 requests per day.

The Department sends multiple units to 11% of the EMS incidents. On average, 1.1 units were dispatched per EMS call. MVA is the category that had 26% of the incidents with more than one Chico unit responding.

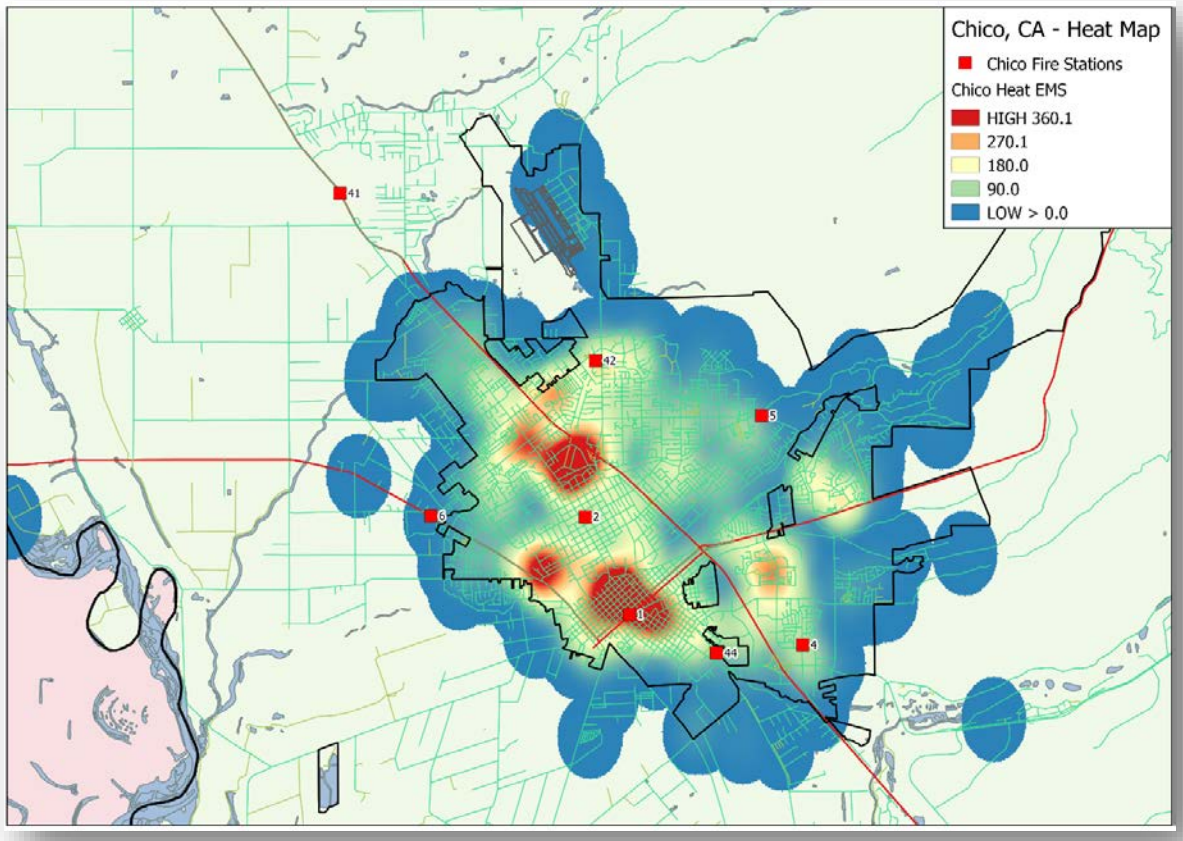
CFD units made a total of 7,673 responses to EMS calls. The total time on task was 1,838 hours, and the average time on task was 14.4 minutes. Engine 2 was the most utilized unit in EMS calls, and it made 1,971 responses, and spent 475 hours on task. SQ1 made 1,128 responses and spent 244 hours on task.

Table 34: Workload by Unit for EMS Calls

Station	Apparatus	Apparatus Type	Avg. Busy Minutes per Response	Annual Busy Hours	Annual Total Responses
1	SQ1	Squad	13	244	1,128
	T1	Truck	11.4	247	1,300
	UT1	Utility	29.8	1	1
	Station 1 Total		**12.1**	**491**	**2,429**
2	E2	Engine	14.4	499	2086
	R2	Rescue	34.3	3	5
	UT2	Utility	18.7	2	5
	Station 2 Total		**14.4**	**503**	**2,096**
	E3CR3	Engine or Crash Rescue	19.4	13	41
	UT3	Utility	13.6	1	3
	Station 3 Total		**19**	**14**	**44**
4	E4	Engine	15.3	254	1,000
5	E15	Wildland Engine	25.2	1	2
	E5	Engine	17.4	306	1,055
	Station 5 Total		**17.4**	**307**	**1,057**
6	E6	Engine	**15.1**	**250**	**997**
Admin	CF1	Chief Vehicle	4.9	0	1
	CF4	Chief Vehicle	6.7	0	3
	D1	Division Chief Vehicle	30.9	8	16
	D2	Division Chief Vehicle	19	4	11
	D3	Division Chief Vehicle	17.8	3	10
	D4	Division Chief Vehicle	21.9	3	9
	Admin Total		**22**	**18**	**50**
CFD Total			**14.4**	**1,838**	**7,673**

Geospatial analyses were completed on all EMS incidents. The GIS analyses mapped historical call volume with the fire station locations identified. When reviewing the maps, the darker the shade (red) the greater frequency of calls. For example, the greatest density of EMS calls for this period is disproportionately found in fire station demand zones 1 and 2. The EMS demand map is presented below.

Figure 22: EMS Demand Map



Community Risks

The Chico Fire Department is located within Butte County, CA and has a population of over 89,180 and a population density of nearly 3,000 per square mile (US Census, 2014).

Utilizing the collective US Census data for the City, approximately 6% of the population is under 5 years of age and 11% of the population is more than 65 years of age. These two groups are noted as the United States Fire Administration (USFA) designates these groups as high risk for injury or death from fire. A summary provided by the US Census QuickFacts is provided below.[34]

Table 35: Summary of Population QuickFacts from US Census

People QuickFacts	Chico	California
Population estimates, July 1, 2015, (V2015)	89,180	39,144,818
Persons under 5 years, percent, April 1, 2010	5.7%	6.8%
Persons under 18 years, percent, April 1, 2010	19.5%	25.0%
Persons 65 years and over, percent, April 1, 2010	10.6%	11.4%

[34] US Census 2013 Estimates. Retrieved from http://quickfacts.census.gov

A 2015 report provided by the Butte County Public Health Department titled, *Community Health Assessment* was utilized to describe some of the community risks associated with illness and injuries. The leading cause of illness and injury mortality in Butte County is cancer followed by coronary heart disease and accidents. Unintentional deaths due to fire and smoke are incorporated into the unintentional accidents. A summary of these results is reproduced below from the Butte County Public Health Department report.

Figure 23: Leading Causes of Mortality in Butte County compared to State of California 2010-2012[35]

Table Status-52: Mortality rates in Butte County and California, 2010-2012.

Cause of Death	Butte County (age adjusted death rates)	California Current (age adjusted death rates)	National Objective
All causes	790.2	641.5	a
All Cancers	180.8	153.3	160.6
Coronary Heart Disease	105.3	106.2	100.8
Accidents (un-intentional injuries)	66.2	27.3	36
Chronic Lower Respiratory Disease	58.4	36.2	a
Lung Cancer	45.1	34.8	45.5
Cerebrovascular Disease (stroke)	44.4	36.6	33.8
Alzheimer's Disease	42.8	30.5	a
Drug-induced Deaths	37.1	10.8	11.3
Prostate Cancer	24.6	20.5	21.2
Female Breast Cancer	23	20.9	20.6
Diabetes	17.3	20.4	b
Suicide	17.3	10.1	10.2
Chronic Liver Disease	15.8	11.5	8.2
Influenza/ Pneumonia	15.1	16.1	a
Colorectal Cancer	13.9	14.2	14.5
Motor Vehicle Accidents	13.7	7.3	12.4
Firearm-Related Deaths	11	7.7	9.2
Homicide	4.5	5.2	5.5

Sources: California Department of Public Health, 2010-2012 Death Statistical Master Files.
a. Healthy People 2020 (HP 2020) National Objective has not been established.
b. National Objective is based on both underlying and contributing cause of death which requires use of multiple cause of death files.

It is important to note that drug-induced deaths are nearly four times the State of California rate, accidental deaths (not including vehicle accidents) are nearly three times the State rate and motor vehicle accidents are nearly twice the State rate.

[35] Butte County Department of Public Health, Community Health Assessment accessed online at http://www.buttecounty.net/Portals/21/Admin/Accreditation/Public/BC_CommunityHealthAssessment_March2015.pdf

Chico State University and Butte College, like many colleges in the United States, experience binge drinking and associated negative impacts among young adults. According to the National Institute on Alcohol Abuse and Alcoholism[36]:

> Virtually all college students experience the effects of college drinking – whether they drink or not. The problem with college drinking is not necessarily the drinking itself, but the negative consequences that result from excessive drinking. About four out of five college students drink alcohol. About half of college students who drink, also consume alcohol through binge drinking. Each year, drinking affects college students, as well as college communities, and families. Nationally, the consequences of drinking include:
>
> - Death: 1,825 college students between the ages of 18 and 24 die each year from alcohol-related unintentional injuries.
> - Assault: More than 690,000 students between the ages of 18 and 24 are assaulted by another student who has been drinking.
> - Sexual Abuse: More than 97,000 students between the ages of 18 and 24 are victims of alcohol-related sexual assault or date rape.
> - Injury: 599,000 students between the ages of 18 and 24 receive unintentional injuries while under the influence of alcohol.
> - Health Problems/Suicide Attempts: More than 150,000 students develop an alcohol-related health problem and between 1.2 and 1.5 percent of students indicate that they tried to commit suicide within the past year due to drinking or drug use.

[36] National Institute on Alcohol Abuse and Alcoholism accessed at https://www.niaaa.nih.gov/alcohol-health/special-populations-co-occurring-disorders/college-drinking

Figure 24: Adult binge drinking in the past year; 2011-2012[37]

Alcohol abuse

One of the most common forms of alcohol abuse is binge drinking. Binge drinking is defined as having had five or more drinks on a single occasion at least once in the past month. It is associated with health problems including: unintentional injuries; intentional injuries; alcohol poisoning; liver disease; sexually transmitted diseases; and cardiovascular diseases among others[34].

Table Status-34: Adult binge drinking in the past year; 2011 - 2012

Binge drinking in the past year	Butte		California	
	Population	Percentage	Population	Percentage
No binge drinking in past year	110,000	64.7%	19,164,000	68.9%
Binge drinking in past year	60,000	35.3%	8,632,000	31.1%
Total	170,000	100.0%	27,796,000	100.0%

Source: 2011 - 2012 California Health Interview Survey

In Butte County, adults age 18 and over reported binge drinking at a higher rate than both the statewide and national rates between 2011 and 2012 (see *Table Status-34*). This is likely influenced by the percentage of young adults attending college and universities in Butte County, as statewide and national data suggest that binge drinking is a particular concern among college age adults, with over fifty percent of college students reporting binge drinking nationally[35].

Underage drinking is associated with a wide range of health, social, and academic challenges. Teen alcohol consumption has been linked to risky health behaviors such as unprotected sex and impaired driving, poor academic performance, physical and/or dating violence, motor vehicle accidents, crime, and suicide attempts[36].

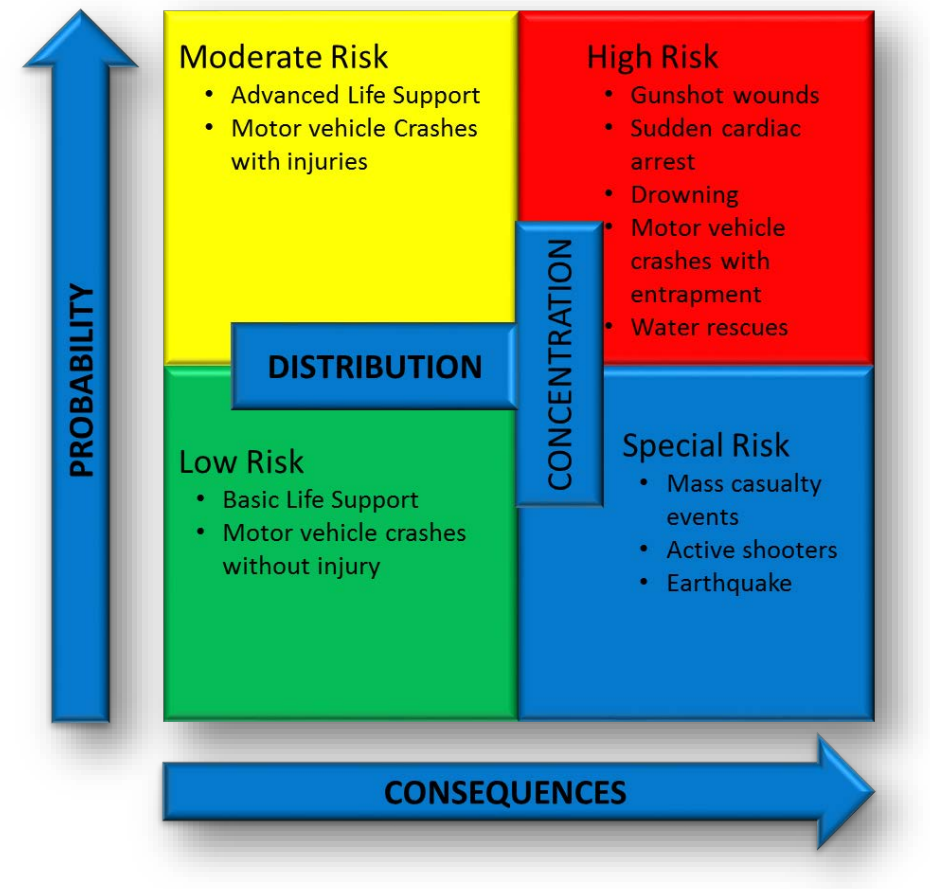
Probability/Consequence of EMS Risk

The probability and consequence process used for the EMS risk assessment is derived by the call taking process and call typing at the dispatch center. These call typing determinants are the framework for first responder and Butte County EMS Ambulance responses.

The analysis evaluates the probability and consequence of EMS incidents. The results are presented below.

[37] Butte County Department of Public Health, Community Health Assessment accessed online at http://www.buttecounty.net/Portals/21/Admin/Accreditation/Public/BC_CommunityHealthAssessment_March2015.pdf

Figure 25: Probability and Consequence Matrix for EMS Risk



Critical Task Analysis

To align resource allocation and risk for emergency medical services, the Department staff completed a critical task analysis. Results found that the most efficient and effective utilization of resources is to send the most efficient resources to the level of risk and patient acuity identified. Therefore, low risk events may receive a single BLS resource while a high-risk incident may receive a single BLS resource and support. As a matter of pre-determined dispatch, high risks required multiple resources to effectively mitigate the identified risk. Similarly, a process was completed to identify the resources allocated to ensure that the personnel required for the critical tasking is accomplished. The tables below reflect call types and resource allocations.

Table 36: Emergency Medical Incident - Low Risk

Critical Task	Needed Personnel
Patient Care / Assessment	(2) 3
Total	**2**

Table 37: Resource Allocation for Emergency Medical Incident – Low Risk

Responding Units	Minimum Staffing
Engine / Truck	3 (4)
Total Response Provided	**3 (4)**
Personnel Required by Critical Tasks	**2**

** When it is the Squad only 2 personnel respond*

Table 38: Motor Vehicle Crash Without Injuries - Low Risk

Critical Task	Needed Personnel
Patient Care / hazard abatement	3
Total	**3**

Table 39: Resource Allocation for Motor Vehicle Crash Without Injuries - Low Risk

Responding Units	Minimum Staffing
Engine / Truck	3 (4)
Total Response Provided	**3 (4)**
Personnel Required by Critical Tasks	**3**

Table 40High Risk – Cardiac Arrest / CPR

Critical Task	Needed Personnel
Patient Care / Assessment	5
Total	**5**

Table 41: Resource Allocation for High Risk – Cardiac Arrest / CPR

Responding Units	Minimum Staffing
Chico Engine/Truck	3 (4)
County Engine or Chico Squad	2
Total Response Provided	**5 (6)**
Personnel Required by Critical Tasks	**5**

Table 42: Motor Vehicle Crash with Injuries – BLS Low Risk

Critical Task	Needed Personnel
Patient Care / Assessment	2
Hazard Abatement	1
Total	**3**

Table 43: Resource Allocation for Motor Vehicle Crash with Injuries - BLS Low Risk

Responding Units	Minimum Staffing
Engine/Truck	3 (4)
Total Response Provided	**3 (4)**
Personnel Required by Critical Tasks	**3**

Table 44: Traffic Collision with Extrication / Fire - High Risk

Critical Task	Needed Personnel
Patient Care	2
Stabilization	2
Extrication	2
Charged Line	1
Command/Control	1
Total	**8**

Table 45: Resource Allocation for Traffic Collision with Extrication / Fire - High Risk

Responding Units	Minimum Staffing
Division Chief	1
Engine	3
Engine	3
Truck	4
Total Response Provided	**11**
Personnel Required by Critical Tasks	**8**

*Note: * Closest engine may respond if not equipped*

Hazardous Materials Services

Chico is in an area that has hazardous materials risk potential from fixed facilities and transportation of materials. The Department utilizes a three-tiered system to respond to and mitigate hazardous materials incidents. All fire department personnel are trained to the Hazardous Materials First Responder Operational level for hazardous materials, thus making the fire suppression force the first line of response for low-risk events. Low risk events would receive a response for early size-up and hazard abatement within their level of training and resources.

More significant hazardous materials events that require additional resources for decontamination, entry, and medical monitoring receive a Level 2 response to effectively and efficiently mitigate the event. Moderate risk events are primarily answered by the Department's HazMat Team. However, for high-risk and large events, Level 3, that require considerable duration and relief, the Department participates and utilizes the full Department and Countywide compliment of hazardous materials resources including Hazardous Materials Specialists and Technicians to assemble the appropriate effective response force.

Community Service Demands

Fortunately, for the Department the Community's demand for hazardous materials services is limited. While there is a potential exposure to hazardous materials risk, the demand for responses is low. This category accounted for 86 unique dispatches in Fiscal Year 2015, or 0.8% of the total call volume. Hazardous materials responses are included in this category and data is reproduced below.

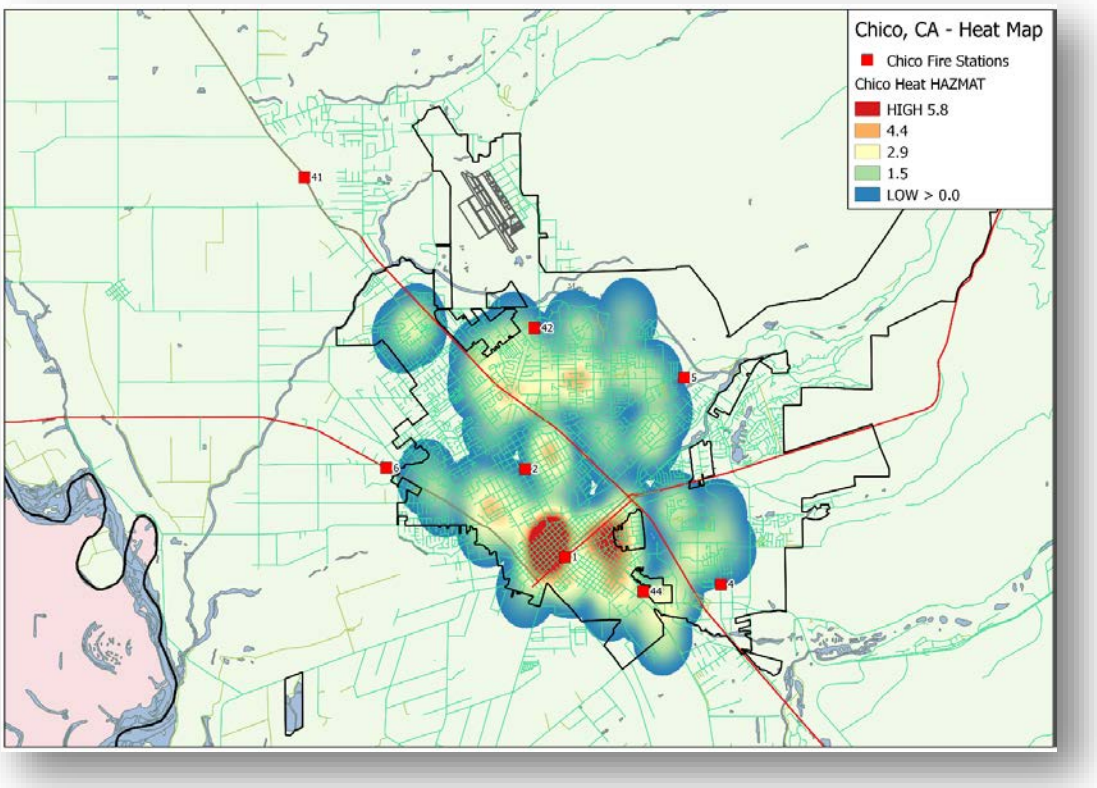
Table 46: Number of Incidents Dispatched by Category – Fiscal Year 2015

Call Category	Number of Calls	Calls per Day	Call Percentage
EMS	6,824	18.7	63.6
Fire	1,959	5.4	18.2
Rescue	11	0.0	0.1
Haz Mat	86	0.2	0.8
Mutual/Auto Aid	493	1.4	4.6
Cancelled	1,365	3.7	12.7
Total	**10,738**	**29.4**	**100.0**

The relative low call volume renders temporal analyses unreliable since the events will be much more random than in larger data sets. In other words, the results would not be intuitive for decision-making and no further analytical analyses were conducted.

However, a geospatial analysis of the requests for hazardous materials incidents was conducted and is represented below. The distribution of calls is generally distributed throughout the South and West areas of the Department, near Downtown and Chico State University. Due to the relatively low frequency of hazardous materials incidents, the geospatial analysis does not suggest a more appropriate location to deploy resources for hazardous materials.

Figure 26: Hazardous Materials Incidents Demand Map



Community Risks

The City and the Department have existing hazardous materials risks between the fixed facilities and the transportation routes to move materials. Butte County Department of Public Health is the administrator of the local Certified Unified Program Agency (CUPA). The CUPA inspects businesses or facilities that handle or store hazardous materials; generate and/or treat hazardous waste; own or operate underground storage tanks; store petroleum in aboveground tanks over State thresholds; and store Federal regulated hazardous materials over State thresholds. The inspections determine compliance with the California Health and Safety Code, California Code of Regulations, and the Code of Federal Regulations. The CUPA Program achieves compliance through education, community and industry outreach, inspections and enforcement[38].

The most prevalent hazardous materials reported in storage were diesel fuel, gasoline, and lube oil. The most prevalent extremely hazardous materials reported in storage are sulfuric acid, ammonia, and chlorine.

Chico State University uses a variety of hazardous materials for daily operations as well as academic teaching and research. The University maintains an Office of Environmental Health & Safety (EH&S) that is responsible for ensuring compliance with the regulations applicable to the hazardous materials stored and utilized on Campus and at the University Farm.

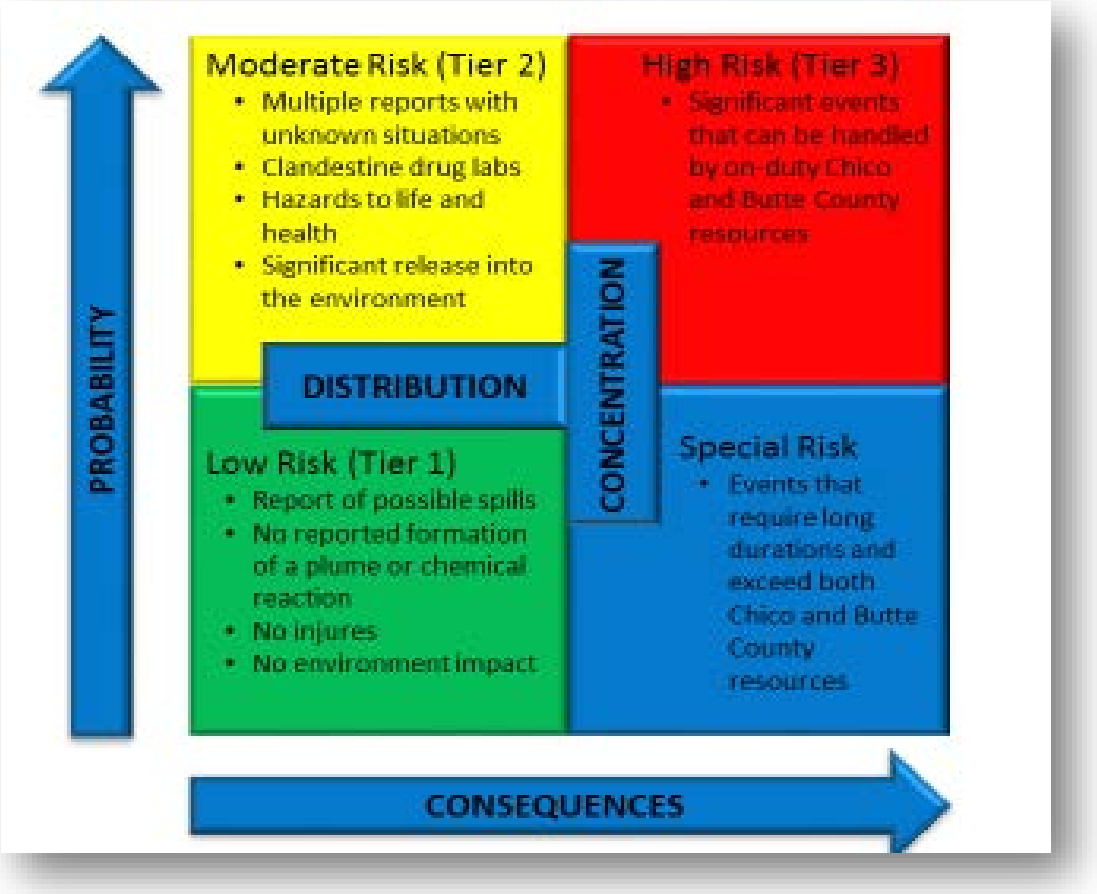
Probability/Consequence of Hazardous Materials Risk

The Department staff completed analyses for the probability and consequence of hazardous materials events. In this case, the risks for hazardous materials are greater than the historical experience. Therefore, the consequence portion of the matrix had greater influence on the risk classification than the probability. All hazardous materials events are relatively low frequency as compared to other community service demands but the consequence of events could be significant.

A probability and consequences risk matrix was developed and is presented below.

[38] Butte County Public Health Haz Mat, accessed online at http://www.buttecounty.net/publichealth/EnvironmentalHealth/Hazmat-CUPA.aspx

Figure 27: Probability and Consequences Hazardous Materials Risk Matrix



Critical Task Analysis

The Department staff analyzed the critical tasks required for the mitigation of the various hazardous materials risks in the community. Critical tasks for low, moderate, and high risk events are presented as well as the resources allocated to each event below.

Table 47: Level 1 Hazardous Materials Event - Low Risk

Critical Task	Needed Personnel
Command / Control	1
Investigate	2
Total	**3**

Table 48: Resource Allocation for a Level 1 Hazardous Materials Incident - Low Risk

Responding Units	Minimum Staffing
Engine	3
Total Response Provided	**3**
Personnel Required by Critical Tasks	**3**

Table 49: Level 2 Hazardous Materials Event - Moderate Risk

Critical Task	Needed Personnel
Command / Control	1
Assistant Safety Officer	1
Entry Team	2
Decon	2
Technical Assistance	2
Isolate and Deny Entry / Evacuation	2
Medical (Private Ambulance)	2
Total	**12**

Table 50: Resource Allocation for a Level 2 Hazardous Materials Incident – Moderate Risk

Responding Units	Minimum Staffing
Engine	3
Engine	3
Division Chief	1
Hazmat Unit	3
Private Ambulance	2
Total Response Provided	**12**
Personnel Required by Critical Tasks	**12**

Table 51: Level 3 Hazardous Materials Event - High Risk

Critical Task	Needed Personnel
Incident Command	1
Incident Safety	1
HazMat Group Supervisor (Technician)	1
HazMat Safety (Technician)	1
Entry Team Leader (Technician)	1
Entry Team (Technician)	3
Backup Team (Technician)	2
Decon (1 Technician)	3
Research (Technician)	1
Medical (1 Technician)	2
Support / Personnel	2
Total	**18**

Table 52: Resource Allocation for a Level 3 Hazardous Materials Event - High Risk

Responding Units	Minimum Staffing
Engine	3
Engine	3
Engine	3
Engine	3
Division Chief	1
Hazmat Unit	3
Truck	4
Medical (Private Ambulance)	2
Total Response Provided	**20**
Personnel Required by Critical Tasks	**18**

Rescue Services

The Department has several members trained as technicians for the Technical Rescue Program and both relies on and participates with the Countywide Technical Rescue Team. Technical rescue is a relatively broad term and includes responses to a wide variety of incidents such as surface water rescue, confined space rescue, low and high angle rescues, and structural collapse. Due to the critical tasking elements necessary for technical rescue events the Department utilizes a tiered response process that begins with Department resources, then escalates to a region-wide response.

A Department response includes operations level personnel in addition to available technicians. A region-wide response includes additional staffing and resources commensurate with a high-risk fire structure fire response including on-duty Department technicians and team leaders as well as region-wide Rescue Team units.

Community Service Demands

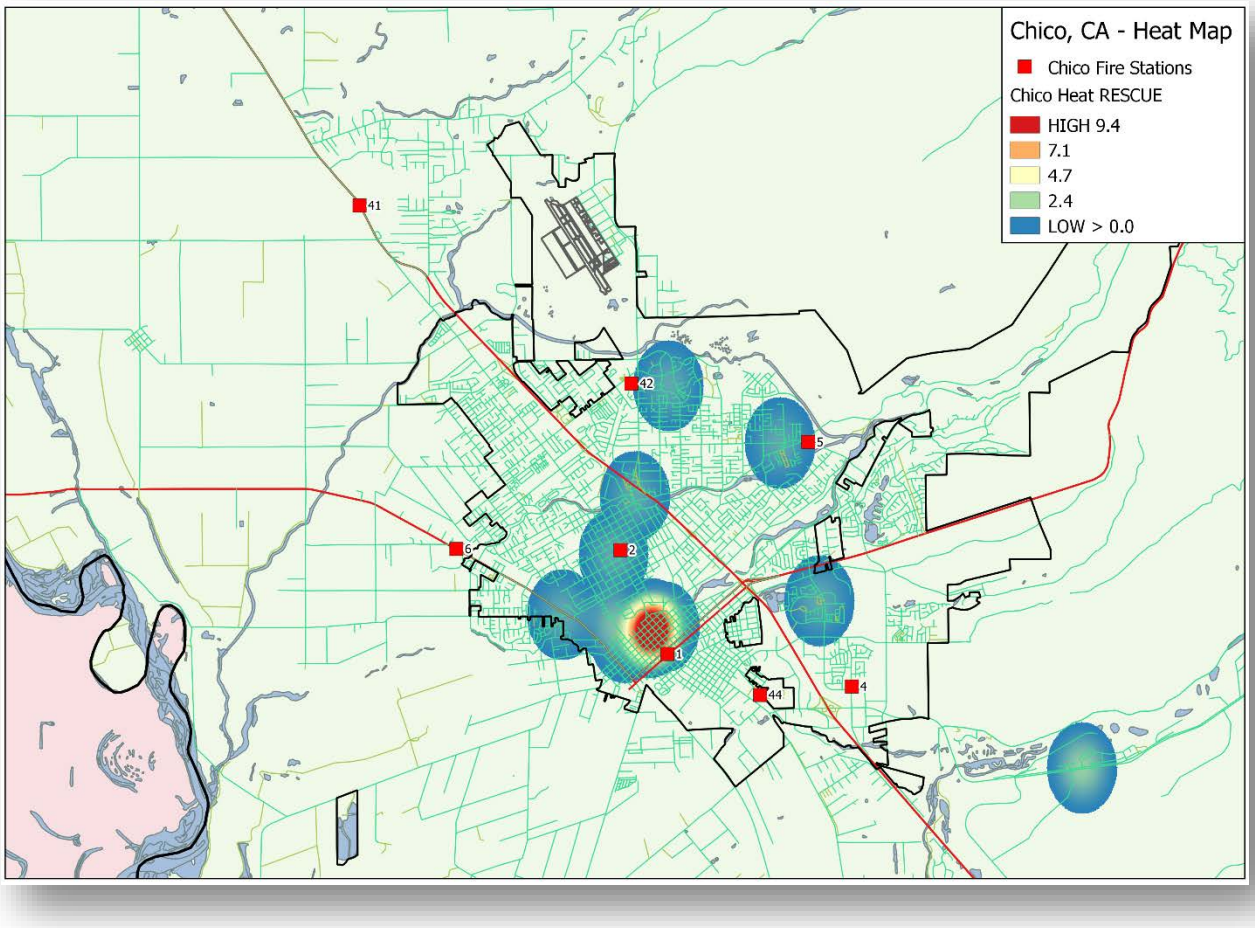
Similar to the analyses for hazardous materials, the demand for technical rescue services is low in relation to the primary service areas. In Fiscal Year 2015, there were 11 rescue incidents dispatched. With the improved economy, the Department is experiencing an upswing in building, so there is potential risk for high angle rescues, trench emergencies, and structural collapses. Due to the relatively low community demand for services temporal analyses would not produce intuitive results for decision-making. Therefore, no additional analytical assessments were conducted.

Table 53: Number of Incidents Dispatched by Category – Fiscal Year 2015

Call Category	Number of Calls	Calls per Day	Call Percentage
EMS	6,824	18.7	63.6
Fire	1,959	5.4	18.2
Rescue	11	0.0	0.1
Haz Mat	86	0.2	0.8
Mutual/Auto Aid	493	1.4	4.6
Cancelled	1,365	3.7	12.7
Total	**10,738**	**29.4**	**100.0**

However, a geospatial analysis was completed for special operations incidents and is reflected below. The frequency of data does not support trend assumptions.

Figure 28: Special Operations Demand Map



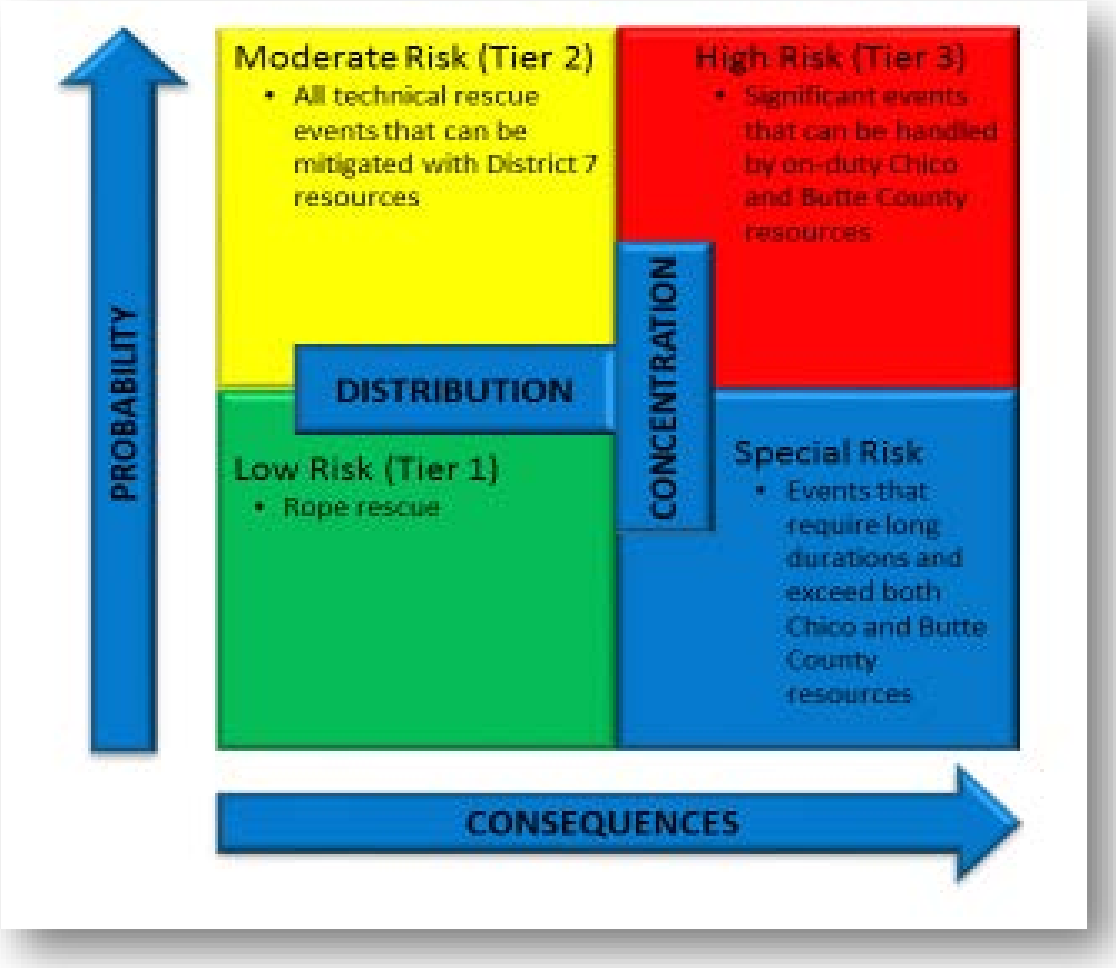
Community Risks

The CFD resides within Butte County, CA. As a mixed-density (Urban, Suburban, Rural) jurisdiction the Department has some risk potential for technical rescue incidents due to outdoor recreational activities in Upper Bidwell Park and waterways, including the Sacramento River, construction demands, ongoing repair to infrastructure, transportation routes, and active railways.

Probability/Consequence of Technical Rescue Risk

The Department staff completed analyses for the probability and consequence of technical rescue events. In this case, the risks for technical rescue, and the Department's technicians, are greater than the historical experience. Therefore, the consequence portion of the matrix had greater influence on the risk classification than the probability. All technical rescue events are relatively low frequency as compared to other community service demands. A probability and consequences risk matrix was developed and is presented below.

Figure 29: Probability and Consequences Technical Rescue Risk Matrix



Critical Task Analysis

The Department staff analyzed the critical tasks required for the mitigation of the various technical rescue risks in the community. Critical tasks for moderate and high risk events are presented as well as the resources allocated to each event. The figures below represent the critical tasks.

Table 54: Technical Rescue Incident

Critical Task	Needed Personnel
Command / Control	1
Locate / Access	6
Stabilize / Patient Care / Transport	3
Total	**10**

Table 55: Resource Allocation for Technical Rescue Incident

Responding Units	Minimum Staffing
Engine	3
Engine	3
Rescue	3 (4)
Division Chief	1
*Ensure 5 Technician Level and 1 Team Leader	(6)
Ambulance (Private)	2
Total Response Provided	**12 (19)**
Personnel Required by Critical Tasks	**10**

Table 56: Resource Allocation for Surface Water Rescue

Responding Units	Minimum Staffing
Division Chief	1
Engine	3
Engine	3
Rescue	3 (4)
*Ensure 5 Technician Level and 1 Team Leader	(6)
Ambulance (Private)	2
Total Response Provided	**12 (19)**
Personnel Required by Critical Tasks	**9 (15)**

REVIEW OF SYSTEM PERFORMANCE

The first step in determining the current state of the CFD's deployment model is to establish baseline measures of performance. This analysis is crucial to the ability to discuss alternatives to the status quo and in identifying opportunities for improvement. This portion of the analysis will focus efforts on elements of response time and the cascade of events that lead to timely response with the appropriate apparatus and personnel to mitigate the event. Response time goals should be looked at in terms of total response time, which includes the dispatch or call processing time, turnout time, and travel time, respectively.

Cascade of Events

The cascade of events is the sum of the individual elements of time beginning with a state of normalcy and continuing until normalcy is once again returned through the mitigation of the event. The elements of time that are important to the ultimate outcome of a structure fire or critical medical emergency begin with the initiation of the event. For example, the first on-set of chest pain begins the biological and scientific time clock for heart damage irrespective of when 911 is notified. Similarly, a fire may begin and burn undetected for a period of time before the fire department is notified. The emergency response system does not have control over the time interval for manual recognition or the choice to request assistance.

Therefore, the Chico Fire Department utilizes quantifiable "hard" data points to measure and manage system performance. These elements include alarm processing (with updated CAD), turnout time, travel time, and the time spent on-scene. An example of the cascade of events and the elements of performance utilized by the Department is provided in the figure below.[39]

Detection

Is defined as the element of time between the time an event occurs and someone detects it and the emergency response system has been notified. This is typically accomplished by calling the 911 Public Safety Answering Point (PSAP). The City of Chico's PSAP is the combined City operated Police and Fire Communications Center (Comm Center).

Chico has a signficnant number of structures that are either not monitored by automatic alarm systems or are unprotected by sprinkler systems. A greater opportunity for success would be achieved with nearly immediate detection and notification (alarm) and/or mitigation (sprinkler systems).

[39] Olathe Fire Department. (2012). Adapted from Community Risk and Emergency Services Analysis: Standard of Cover. Olathe, Kansas: Author.

Call Processing

This is the element of time measured between when Comm Center answers the 911 call, processes the information, and subsequently dispatches Department resources. As previously discussed, the current CAD does not capture the time interval from phone answer to the time the call is created. The Department has identified that the new CAD will be able to appropriate capture all time elements.

Turnout Time

This is the element of time that is measured between the time the fire department is dispatched or alerted of the emergency incident and the time when the fire apparatus or ambulance is enroute to the call.

The communication center utilizes a pre-alert or pre-announcement process that may serve to introduce artifact in the transition between call processing and turnout time. For example, if the pre-alert system begins the clock for when turnout time is measured prior to actually dispatching the units, then the turnout time would be elongated and the call processing time would be artificially lowered. If the department moved toward a more sophisticated call triaging tool, then the utilization of pre-alerts could be re-evaluated and the any potential ambiguity in the data removed.

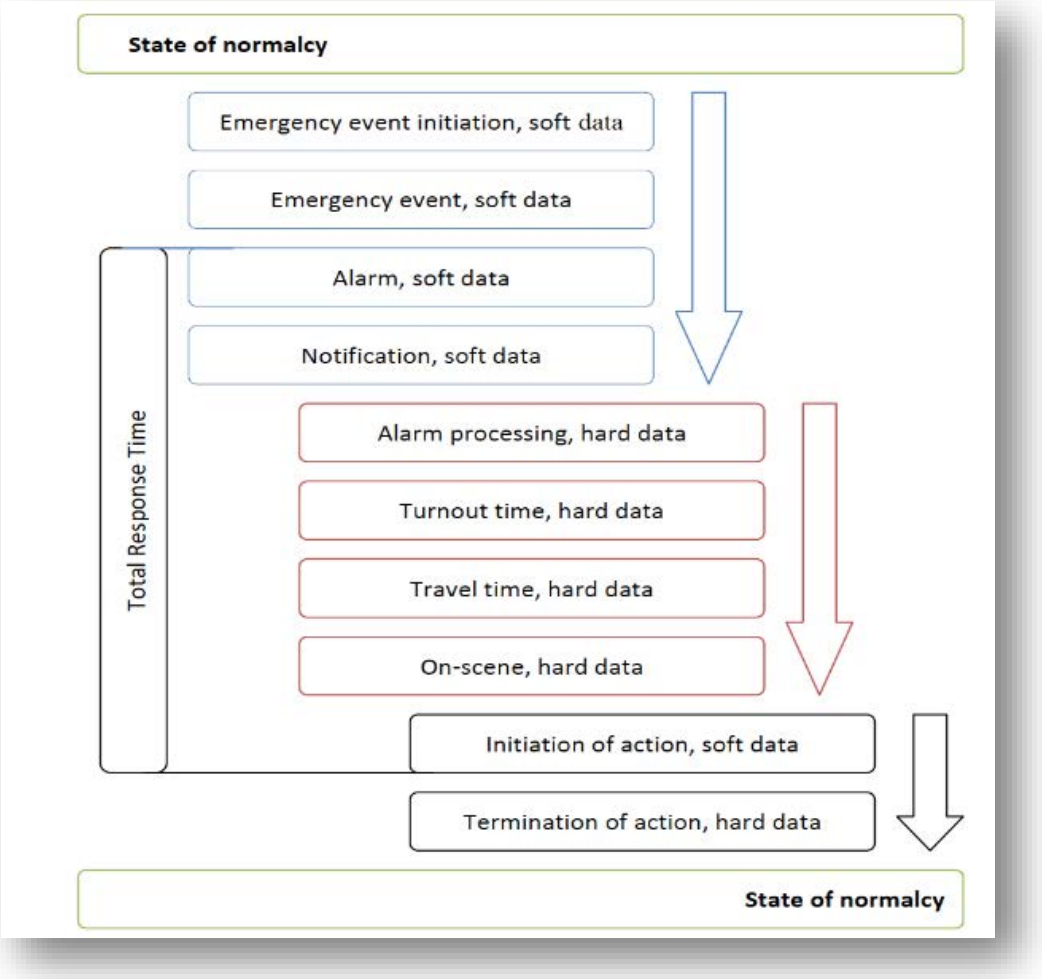
Travel Time

The travel time is the element of time between when the unit went enroute, or began to travel to the incident, and their arrival on-scene.

Total Response Time

The total response time is the total time required to arrive on-scene beginning with Comm Center answering the phone request for service and the time that the units arrive on-scene.

Figure 30: Cascade of Events



Response Time Continuum

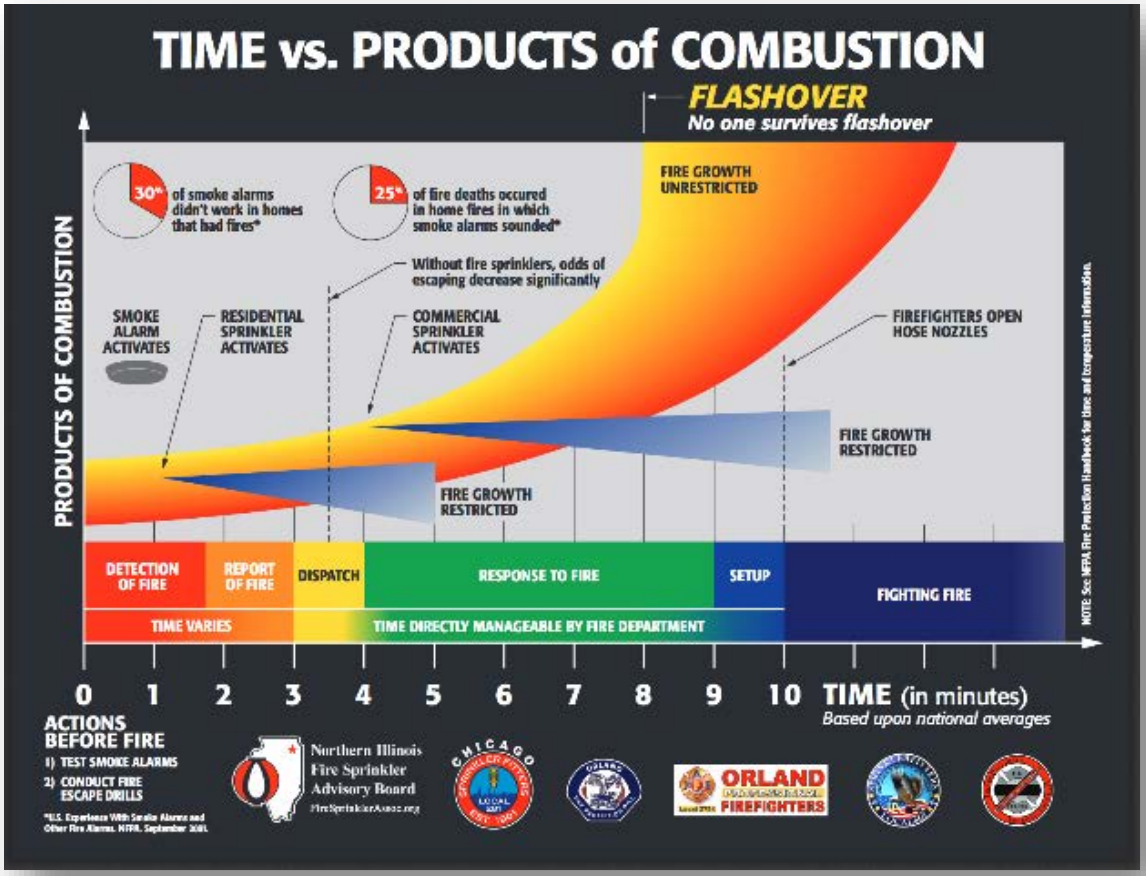
Fire

The number one priority with structural fire incidents is to save lives followed by the minimization of property damage. A direct relationship exists between the timeliness of the response and the survivability of unprotected occupants and property damage. The most identifiable point of fire behavior is Flashover.

Flashover is the point in fire growth where the contents of an entire area, including the smoke, reach their ignition temperature, resulting in a rapid-fire growth rendering the area un-survivable by civilians and untenable for firefighters. Best practices would result in the fire department arriving

and attacking the fire prior to the point of flashover. A representation of the traditional time temperature curve and the cascade of events is provided below.[40]

Figure 31: Example of Traditional Time Temperature Curve

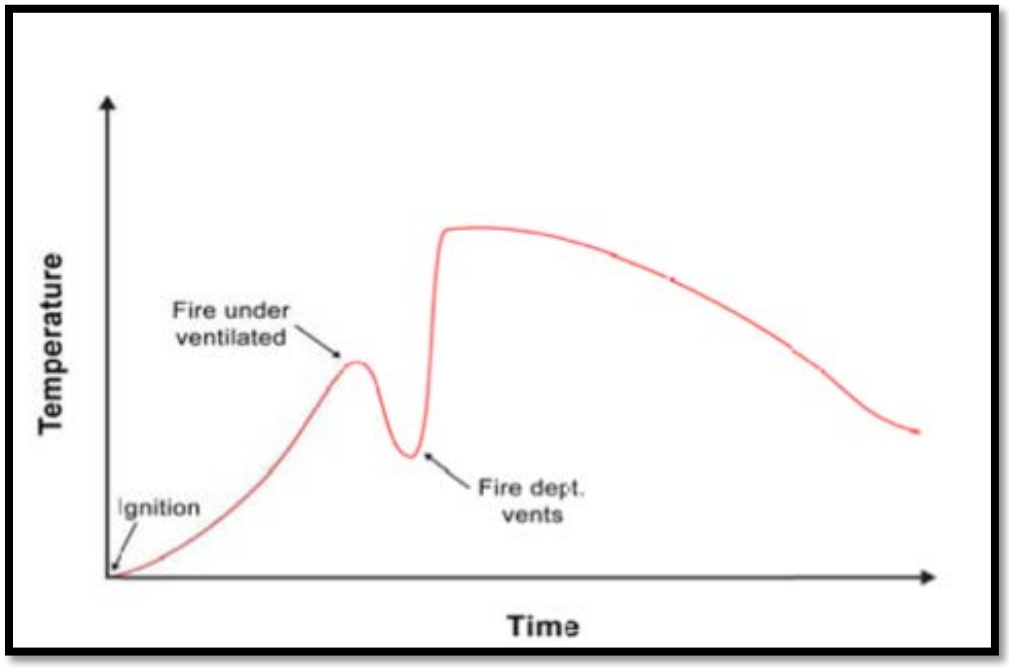


Recent studies by Underwriter's Laboratories (UL) have found that in compartment fires such as structure fires, flashover occurs within 4 minutes in modern fire environment. Modern home environments differ from traditional home environments with the addition of consumer furnishings made from petroleum-based products such as foam cushions and plastics. A compounding effect is also due to the advances in energy efficiency such as found in modern windows, insulation, etc. In addition, the UL research has identified an updated time temperature curve due to fires being ventilation controlled rather than fuel controlled as represented in the traditional time temperature curve. While this ventilation controlled environment continues to provide a high risk to unprotected occupants to smoke and high heat, it does provide some advantage to property conservation efforts as water may be applied to the fire prior to ventilation and the subsequent flashover. An example of UL's ventilation controlled time temperature curve is provided below.[41]

[40] Example of Traditional Time Temperature Curve. Retrieved at http://www.usfa.fema.gov/downloads/pdf/coffee-break/time-vs-products-of-combustion.pdf

[41] UL/NIST Ventilation Controlled Time Temperature Curve. Retrieved from http://www.nist.gov/fire/fire_behavior.cfm

Figure 32: Ventilation Controlled Time Temperature Curve



EMS

The effective response to Emergency Medical Service (EMS) incidents also has a direct correlation to the ability to respond within a specified period. However, unlike structure fires, responding to EMS incidents introduces considerable variability in the level of clinical acuity. From this perspective, the association of response time and clinical outcome varies depending on the severity of the injury or the illness. Research has demonstrated that the overwhelming majority of requests for EMS services are not time sensitive between 5 minutes and 11 minutes for emergency and 13 minutes for non-emergency responses.[42] The 12-minute upper threshold is only the upper limit of the available research and is not a clinically significant time measure, as patients were not found to have a significantly different clinical outcome when the 12-minute threshold was exceeded.[43]

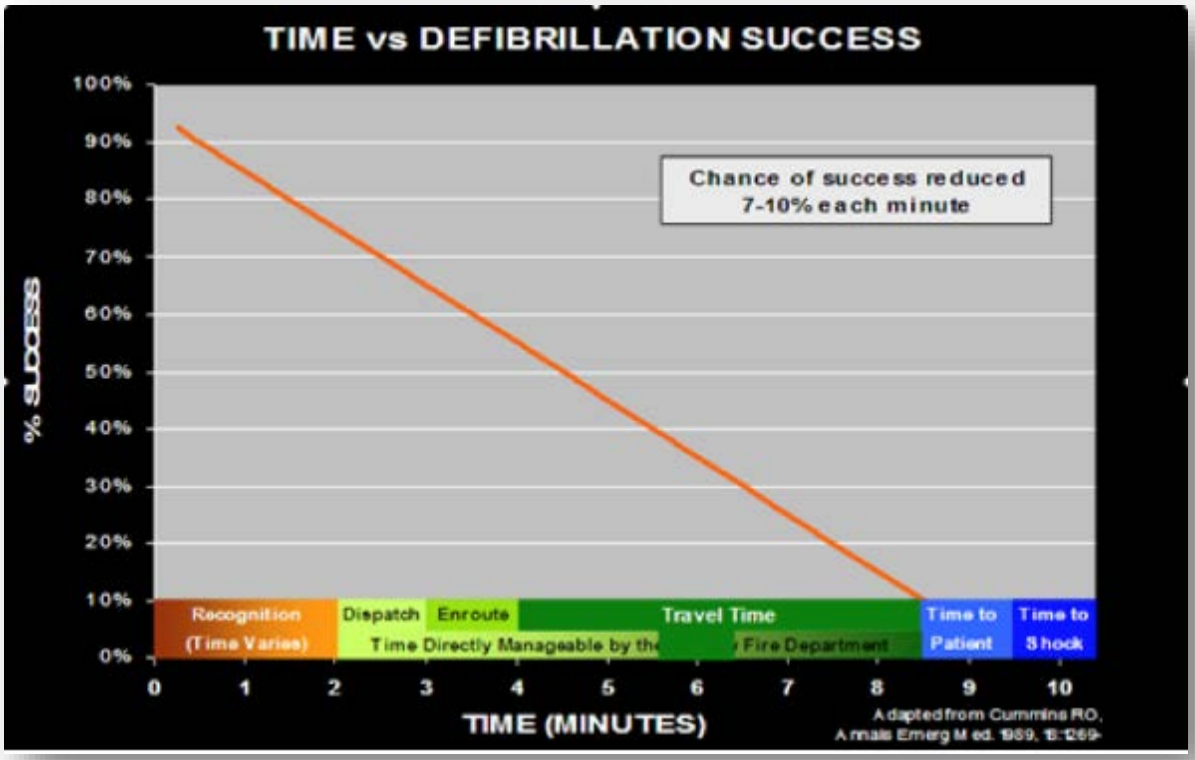
Out of hospital sudden cardiac arrest is the most identifiable and measured incident type for EMS. In an effort to demonstrate the relationship between response time and clinical outcome, a representation of the cascade of events and the time to defibrillation (shock) is presented below. The American Heart Association (AHA) has determined that brain damage will begin to occur between four and six minutes and become irreversible after 10 minutes without intervention.

Modern sudden cardiac arrest protocols recognize that high quality Cardio-Pulmonary Resuscitation (CPR) at the Basic Life Support (BLS) level is a quality intervention until defibrillation can be delivered

[42] Blackwell, T.H., & Kaufman, J.S. (April 2002). Response time effectiveness: Comparison of response time and survival in an urban emergency medical services system. *Academic Emergency Medicine,* 9(4): 289-295.
[43] Blackwell, T.H., et al. (Oct-Dec 2009). Lack of association between prehospital response times and patient outcomes. *Prehospital Emergency Care,* 13(4): 444-450.

in shockable rhythms. The figure [44] below is representative of a sudden cardiac arrest that is presenting in a shockable heart rhythm such as Ventricular Fibrillation (V-Fib) or Ventricular Tachycardia (V-Tach).

Figure 33: Cascade of Events for Sudden Cardiac Arrest with Shockable Rhythm



It is important to note that many confounding variables are present in any of the broad response time to outcome relationships. For example, the recognition and detection phase previously discussed could have the greatest impact on the efficacy of the response system.

Distribution Factors

Comparison of Demand Zones

Each of the six fire demand zones were compared for factors that would impact the distribution of resources. First, a geospatial analysis was conducted to measure both the square miles in each fire station demand zone and the relative road miles. While the geographic analysis is a quality surrogate measure, there are times that the complexity of the roadway system may provide additional challenges. All calls run in the City were utilized regardless of whether the City or County units provided the service.

[44] Olathe Fire Department. (2012). Adapted from Community Risk and Emergency Services Analysis: Standard of Cover. Olathe, Kansas: Author.

Station 4 and 3 are the largest geographic areas at approximately 37 square miles each. The smallest geographic footprints are Station's 2 and 5 at approximately 4.4 and 17.7 square miles, respectively. However, Station 4, 6, and 1's road miles are considerably more extensive per square mile than other demand zones. Results of this analysis are provided below.

Table 57: Geospatial Analysis of Fire Demand Zones

Station Demand Zone	Area (Square Miles)	Linear Roadway (Miles)
1	18.94	118.18
2	4.43	79.31
3	37.18	107.68
4	37.40	161.23
5	17.70	108.68
6	22.22	130.35

Second, geospatial analyses were completed regarding drive times that incorporated the Department's current performance and nationally recommended best practices. Drive times from each of the current fixed facility fire stations were created utilizing existing road miles and impedance for 4 and 6-minute increments. This analysis suggests that the majority of the Department's jurisdiction should be able to be responded to within six (6) minutes for where the majority of the risk is located. The (green) shading indicates the estimated travel time capabilities from the existing road networks. The darker the (green) shading, the more overlap exists between response capabilities within the current configuration. Finally, the number in parenthesis "(1)" indicates the order of contribution to system performance.

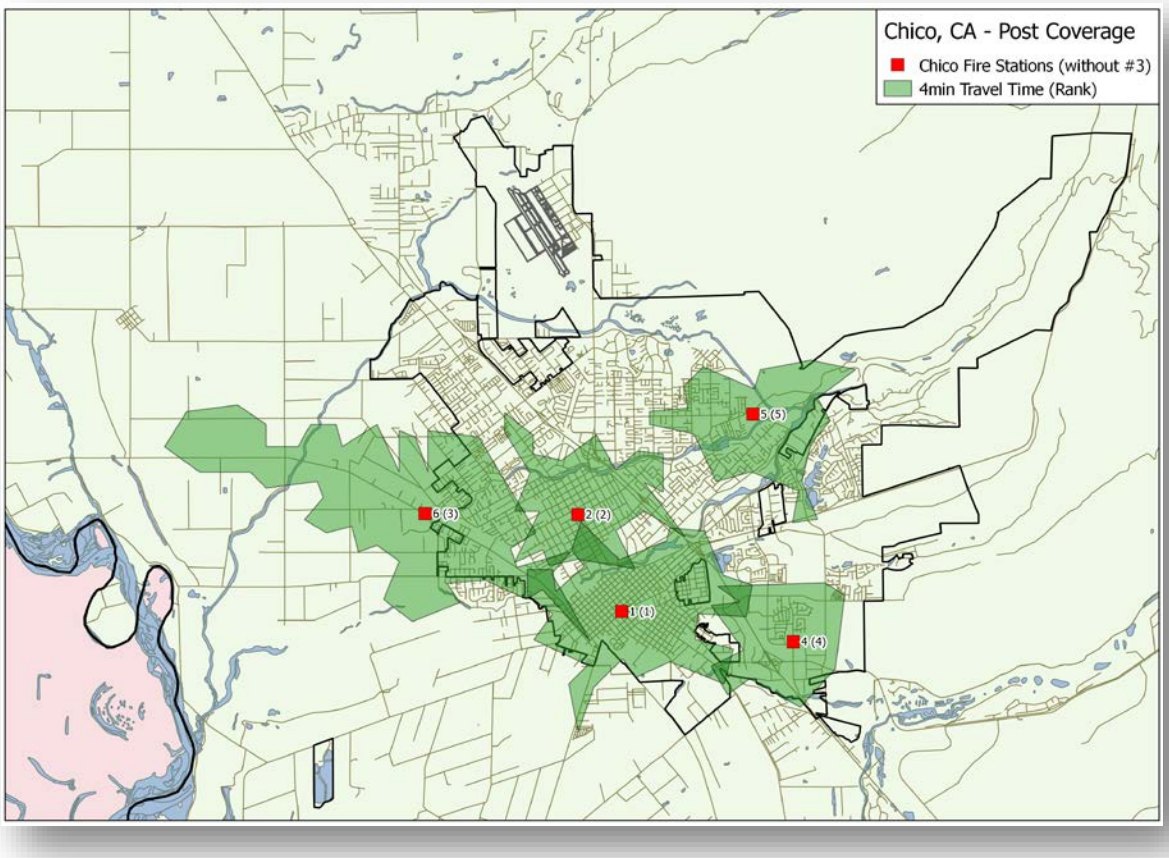
For example, referring to the figure below, a NFPA 1710 evaluation of a 4-minute travel time, the station that contributed the most to the overall system's performance was Station 1 in the first column and would capture 29.09% of the risks within four minutes. Station 2 would cover an additional 16.5% of the risk bringing the cumulative total to 45.59% between Stations 1 and 2. In total, with all five Chico fire stations, 62.71% of the incidents could be responded to within four minutes travel time. Results are provided in drive time mapping format below.

Table 58: Marginal Fire Station Contribution with Chico Fire Stations for 4-Minute Travel Time

Rank	Station Number	Station Capture	Total Capture	Percent Capture
1	1	3512	3512	29.09%
2	2	2113	5625	46.59%
3	6	726	6351	52.60%
4	4	610	6961	57.66%
5	5	545	7506	62.17%

Note: If Station 3 were included it would contribute 0.59% additional coverage.

Figure 34: 4-Minute Travel Time Bleed with Chico Stations (excluding Station 3)

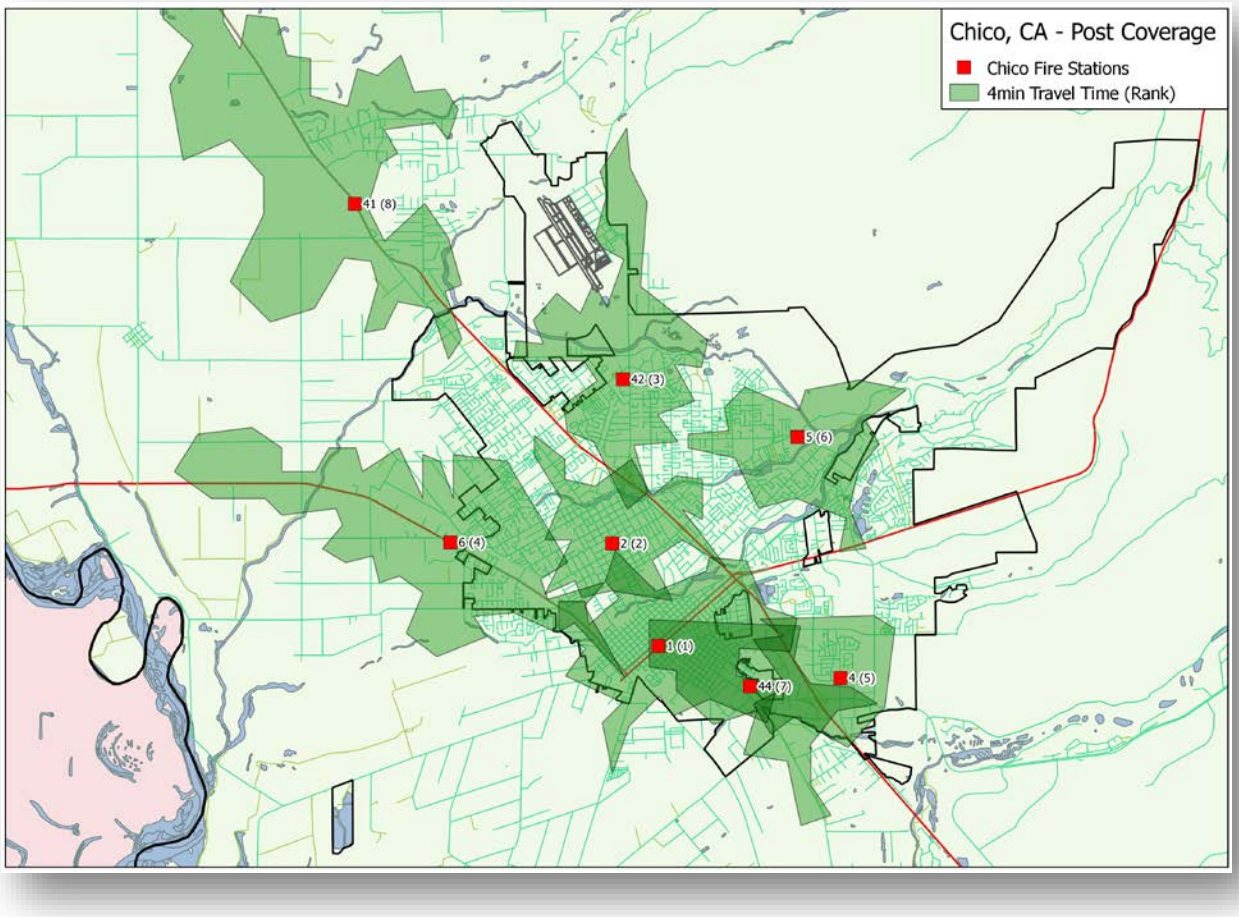


It is understood that the Butte County Fire Department (Cal Fire) provides automatic and mutual aid coverage for the City of Chico and are within relatively close proximity to the City limits. Therefore, an additional analysis was completed to determine the efficacy of the combined system to deliver a four-minute travel time or less to 90% of the incidents. Results found that the County's three fire stations (41, 42, and 44) contributed an additional 12.16% but fell short of the 90th percentile at 74.33%. Station 42 is best positioned to provide improvement and accounted for 11.11% of the 12.16% improvement. Results are provided below.

Table 59: Marginal Fire Station Contribution Chico and County Stations with 4-Minute Travel Time

Rank	Station Number	Station Capture	Total Capture	Percent Capture
1	1	3512	3512	29.09%
2	2	2113	5625	46.59%
3	42	1341	6966	57.70%
4	6	726	7692	63.71%
5	4	610	8302	68.77%
6	5	545	8847	73.28%
7	44	95	8942	74.07%
8	41	32	8974	74.33%

Figure 35: 4-Minute Travel Time Bleed with Chico and County Fire Stations (excluding Station 3)



If all station locations were optimized, it would require a minimum of eight stations to meet a 4-minute travel time at the 90th percentile. The 4-minute travel time requirement, at the 90th percentile, is outside of most departments' capabilities throughout the United States.

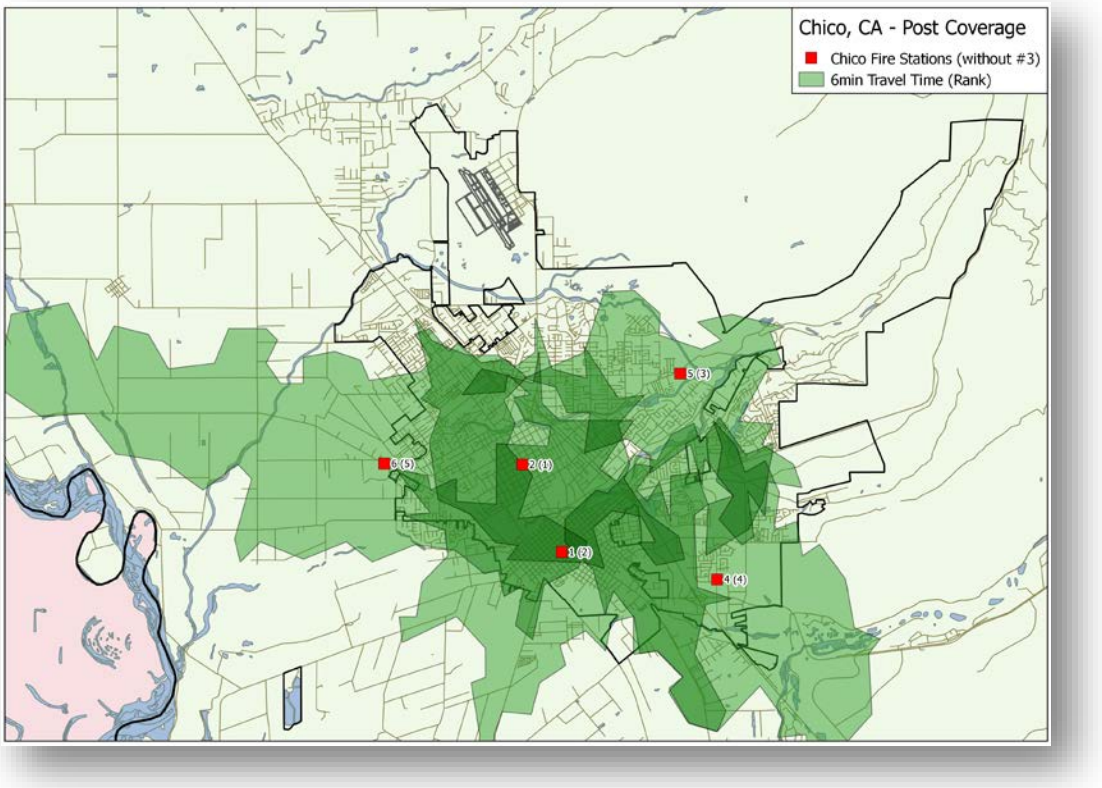
Evaluation of Current Fire Program Performance – 6-Minute Travel Time

Results suggest that if the Department is desirous of maintaining current performance that it will require a five fire station configuration in order to most closely approximate a 6-minute travel time to 90% of the incidents. Station 2 was able to contribute 58.25% of the geographic coverage and the combination of Station 1 and 2 can cover nearly 80% of the historical incidents. Results are provided below.

Table 60: Marginal Fire Station Contribution with Chico Fire Stations for 6-Minute Travel Time

Rank	Station Number	Station Capture	Total Capture	Percent Capture
1	2	7033	7033	58.25%
2	1	2538	9571	79.28%
3	5	698	10269	85.06%
4	4	353	10622	87.98%
5	6	138	10760	89.12%

Figure 36: 6-Minute Travel Time Bleed with Chico Fire Stations (excluding Station 3)



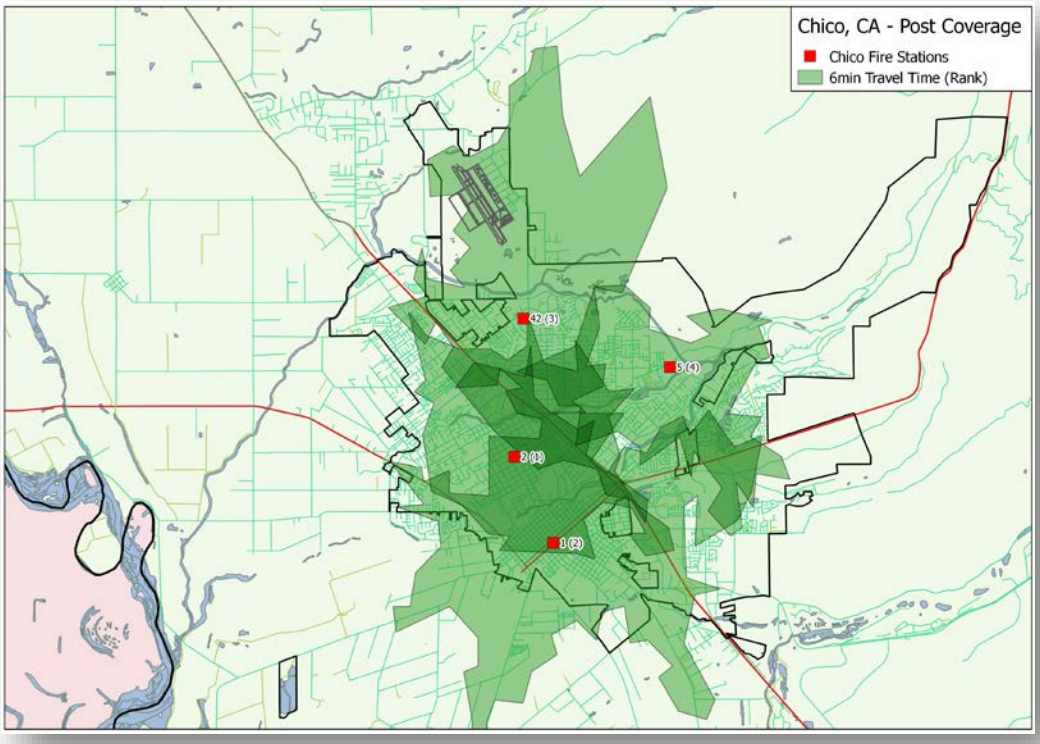
Again, it is understood that the Butte County Fire Department (Cal Fire) provides automatic and mutual aid coverage for the City of Chico and are within relatively close proximity to the City limits. Therefore, additional analyses were completed to determine the efficacy of the combined system to deliver a six-minute travel time or less to 90% of the incidents with the variable assumptions levied.

Results found that the County's three fire stations (41, 42, and 44) contributed an additional 8.8% but the synergy between combined station locations affords a four-station distribution model to maintain the current six-minute travel time performance as well as improves overall performance by approximately 3%. Station 42 is best positioned to provide improvement and accounted for 8.32% of the 8.8% improvement. Results are provided below.

Table 61: Marginal Fire Station Contribution with Chico and County Fire Stations for 6-Minute Travel Time

Rank	Station Number	Station Capture	Total Capture	Percent Capture
1	2	7033	7033	58.25%
2	1	2538	9571	79.28%
3	42	1005	10576	87.60%
4	5	639	11215	92.89%
5	4	353	11568	95.82%
6	6	137	11705	96.95%
7	41	85	11790	97.66%
8	44	32	11822	97.92%

Figure 37: 6-Minute Travel Time Bleed with Chico and County Fire Stations (excluding Station 3)



Comparison of Workloads by Demand Zone

Another method of assessing the effectiveness of the distribution model is to analyze the demand for services across the distribution model. Workload is assessed at the station demand zone level and at the individual unit level.

Analyses illustrate that Station Demand Zones 1 and 2 were the top demand zones, and each answer 24.0% and 28.4% of the total responses for services. Collectively these two demand zones accounted for 52.4% of the total workload. Station Demand Zone 3 accounted for 2.0% of the total responses for services. Results are presented below.

Figure 38: Department Workload by Station Demand Zone

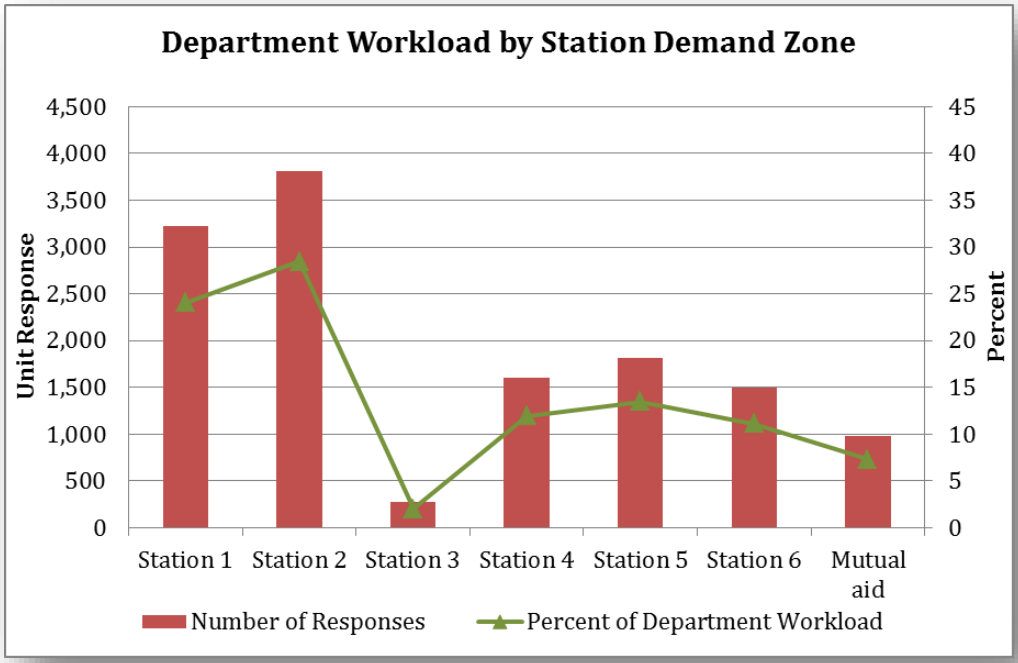


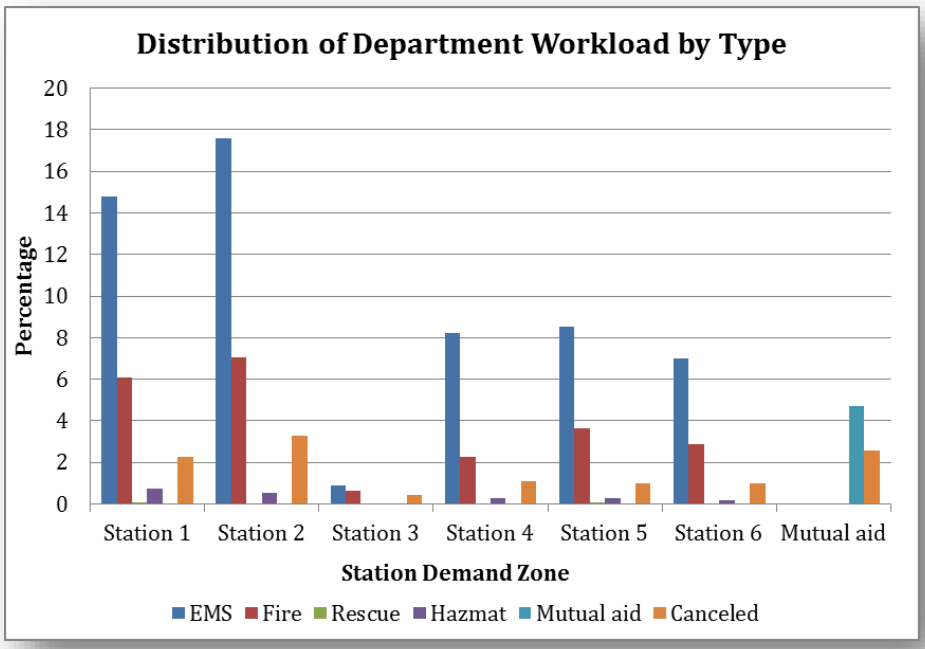
Table 62: Department Workload by Station Demand Zone

Agency	First Due Station	Number of Responses	Responses per Day	Percent of Department Workload
Chico	Station 1	3,220	8.8	24.0
	Station 2	3,813	10.4	28.4
	Station 3	270	0.7	2.0
	Station 4	1,602	4.4	11.9
	Station 5	1,808	5.0	13.5
	Station 6	1,490	4.1	11.1
	Mutual/Auto Aid	978	2.7	7.3
	Missing	228	0.6	1.7
	Total	**13,409**	**36.7**	**100.0**

Note: 228 unit responses were missing first due station information.

Further analyses were completed identifying both the distribution of department workload by program. The overall distribution of department workload supports earlier findings that greater than 57% of the requests for service are EMS related. Approximately 24% of the unit responses were associated with fire related incidents. Canceled requests accounted for 12% of the total. Rescue and Hazmat programs are very small. For both EMS and fire requests, demand zones 1 and 2 ranked the top. The Department's overall distribution of workload by call type and station demand zone is presented below.

Figure 39: Distribution of Department Workload by Call Type



The within station analyses did not reveal any significant deviations from the department's overall experience. Findings are presented below. In addition, the total number of unit responses conducted in each station demand zone is also presented below.

Figure 40: Within Station Proportion of Workload by Call Type

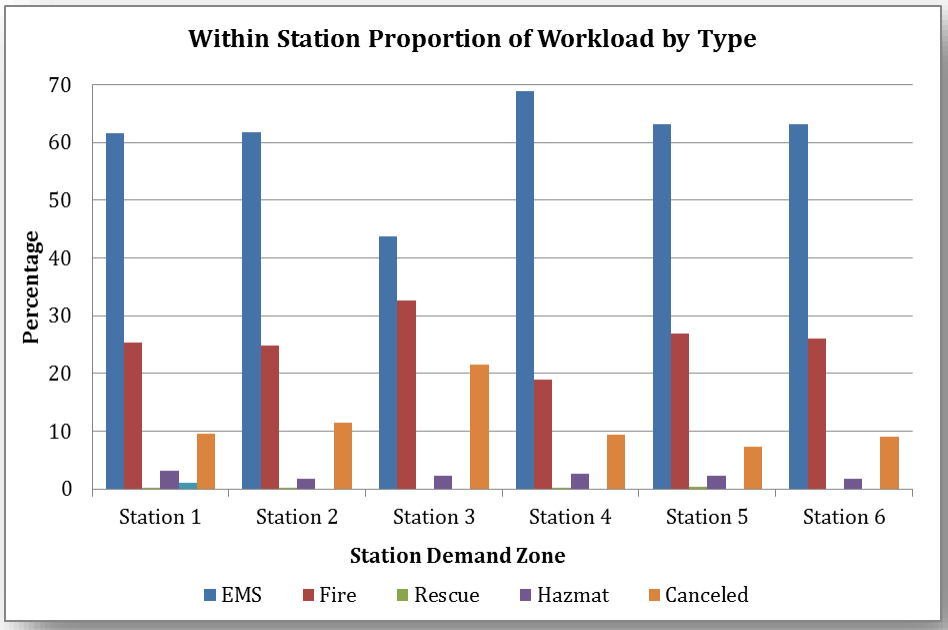


Table 63: Number of Responses by Station Demand Zone and Call Type

First Due Station	EMS	Fire	Rescue	Hazmat	Mutual/Auto Aid	Canceled	Total
Station 1	1,986	818	8	101	0	307	3,220
Station 2	2,356	946	2	71	0	438	3,813
Station 3	118	88	0	6	0	58	270
Station 4	1,105	303	3	41	0	150	1,602
Station 5	1,141	486	8	40	0	133	1,808
Station 6	941	387	0	27	0	135	1,490
Mutual/Auto Aid	0	0	0	0	631	347	978
Missing	26	155	2	7	0	38	228
Total	**7,673**	**3,183**	**23**	**293**	**631**	**1,606**	**13,409**

Finally, unit workload analyses were completed for both comparative purposes as well as for introspection into potential system failures. First, this analysis utilized the summation of individual unit workload from dispatch to clear. E2R2 was dispatched the most with a total of 3,295 runs, followed by T1 and E6. The top six most utilized units all made more than 1,600 responses. Crash Rescue 3 made 266 responses. Results of the unit workload analysis are presented below.

Table 64: Unit Workload Analyses by Unit and Call Category

Station	Unit	Description	EMS	Fire	Rescue	Hazmat	Mutual/Auto Aid	Canceled	Total
2	E2	Engine	2,086	665	5	40	72	427	3,295
1	T1	Truck	1,300	622	7	54	105	294	2,382
6	E6	Engine	997	388	0	41	236	320	1,982
5	E5	Engine	1,055	399	2	29	43	173	1,701
1	SQ1	Squad	1,128	243	2	19	70	161	1,623
4	E4	Engine	1,000	339	3	35	76	164	1,617
3	E3CR3	Engine or Crash Rescue	41	247	1	14	4	18	325
5	HM5	Hazmat	0	7	0	8	6	2	23
5	E15	Wild Land Engine	2	5	0	1	5	7	20
2	UT2	Utility	5	9	0	1	1	3	19
3	UT3	Utility	3	8	1	2	0	0	14
2	R2	Rescue	5	2	0	1	0	2	10
1	BS1	Breathing Support	0	7	0	0	0	0	7
1	UT1	Utility	1	3	0	0	0	1	5
6	UT6	Utility	0	1	0	0	0	0	1

Comparison of Workloads by Unit Hour Utilization (UHU)

Another measure, time on task, is necessary to evaluate best practices in efficient system delivery and consider the impact workload has on personnel. Unit Hour Utilization (UHU) determinants were developed by mathematical model. This model includes both the proportion of calls handled in each major service area (Fire, EMS, Special-Ops, and Service) and total unit time on task for these service categories in 2014. The resulting UHU's represent the percentage of the work period (24 hours) that is utilized responding to requests for service. Historically, the International Association of Fire Fighters (IAFF) has recommended that 24-hour units utilize 0.30, or 30% workload as an upper threshold.[45] In other words this recommendation would have personnel spend no more than eight (8) hours per day on emergency incidents. These thresholds take into consideration the necessity to accomplish non-emergency activities such as training, health and wellness, public education, and fire and community risk reduction inspections.

The 4th edition of the IAFF EMS Guidebook no longer specifically identifies an upper threshold. However, *FITCH* recommends that an upper unit utilization threshold of approximately 0.30, or 30%, would be considered best practice. In other words, units and personnel should not exceed 30%, or eight (8) hours, of their workday responding to calls. These recommendations are also validated in

[45] International Association of Firefighters. (1995). Emergency *Medical Services: A Guidebook for Fire-Based Systems.* California, DC: Author. (p. 11)

the literature. For example, in their review of the City of Rolling Meadows, the Illinois Fire Chiefs Association utilized a UHU threshold of 0.30 as an indication to add additional resources.[46] Similarly, in a standards of cover study facilitated by the Center for Public Safety Excellence, the Castle Rock Fire and Rescue Department utilizes a UHU of 0.30 as the upper limit in their standards of cover due to the necessity to accomplish other non-emergency activities.[47]

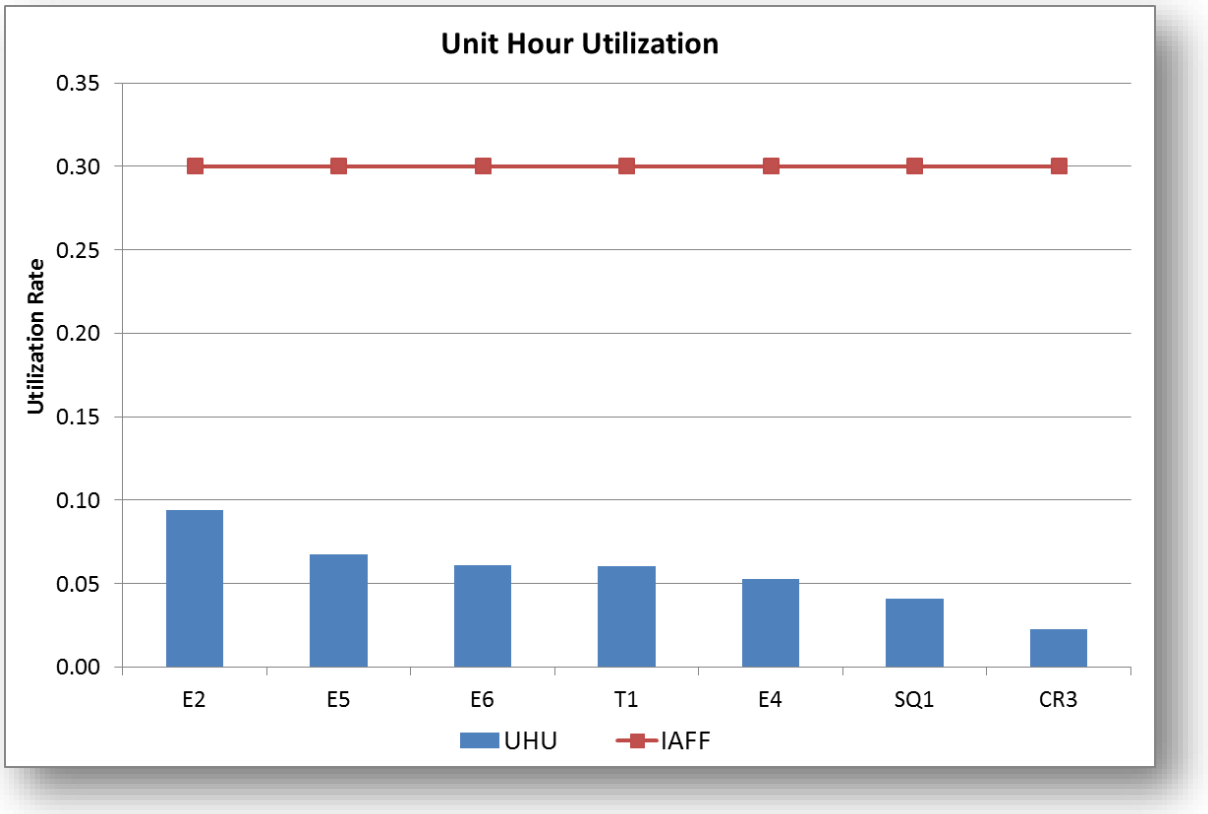
Since Stations 2-6 can only staff one unit at a time, the stations' total workload is grouped into E2, CR3, E4, E5 and E6 to calculate unit utilization. In Station 1, all unit hours except SQ1 were grouped into T1.

In the CFD, the most utilized units are E2 and E5. The least utilized unit was Crash Rescue 3. All unit utilizations were below 10%. This is partly contributed by the relative short average time on task of 16.4 minutes.

Emergency related workload is a factor of community demands for service and is not a reflection of internal policies or non-emergency duties. Any changes to the current system would require workload to be redistributed across the deployed units. For example, if Squad 1 were no longer utilized, Truck 1 would assume the majority of the workload. However, this analysis demonstrates that considerable capacity exists to absorb additional work. At the current workload utilization rates, CFD should have limited impact on their level or readiness or system performance.

[46] Illinois Fire Chiefs Association. (2012). An *Assessment of Deployment and Station Location: Rolling Meadows Fire Department.* Rolling Meadows, Illinois: Author. (pp. 54-55)
[47] Castle Rock Fire and Rescue Department. (2011). Community *Risk Analysis and Standards of Cover.* Castle Rock, Colorado: Author. (p. 58)

Figure 41: Unit Hour Utilizations



Description of First Arriving Unit Performance

Analyses of the response characteristics of the first arriving units were conducted. This analysis focused on lights and sirens responses. Overall CFD had a mean dispatch time of 42 seconds, and 82 seconds or 1 minute 22 seconds at the 90th percentile. CFD has a mean turnout time of 66 seconds, and 118 seconds, or one minute and 58 seconds at the 90th percentile.

The travel time for all first arriving unit responses were calculated irrespective of their assigned station FDZ. In other words, this analysis describes the first arriving unit to the scene. The mean travel time was 204 seconds, or three minutes and 24 seconds. Performance at the 90th percentile was 316 seconds, or five minutes and 16 seconds.

As previously discussed, since CAD calls do not capture the complete dispatch interval, the "total response time" is defined as from call entry through unit arriving on scene. The mean response time is 312 seconds, or five minutes and 12 seconds. Performance at the 90th percentile is 440 seconds, or seven minutes and 20 seconds. Results of first arriving unit performance are provided below.

Table 65: Description of First Arriving Unit Emergency Response Performance

Measure	Average	90th Percentile
Dispatch Time	0.7	1.4
Turnout Time	1.1	2.0
Travel Time	3.4	5.3
Turnout and Travel	4.4	6.6
Response Time	5.2	7.3

First Arriving Unit Response Time by Station Demand Zone

Further analyses were conducted to measure the performance of the first arriving unit in each demand zone. Response times are reported below at both the mean and 90th percentile.

Examination of the overall performance at the 90th percentile reveals that Station 1 had the quickest response times followed by Stations 2, 4, 5, 6 and 3 in order of performance. The FDZ with the longest total response times is station 3. An illustrative comparison of FDZ performance at the 90th percentile is provided below.

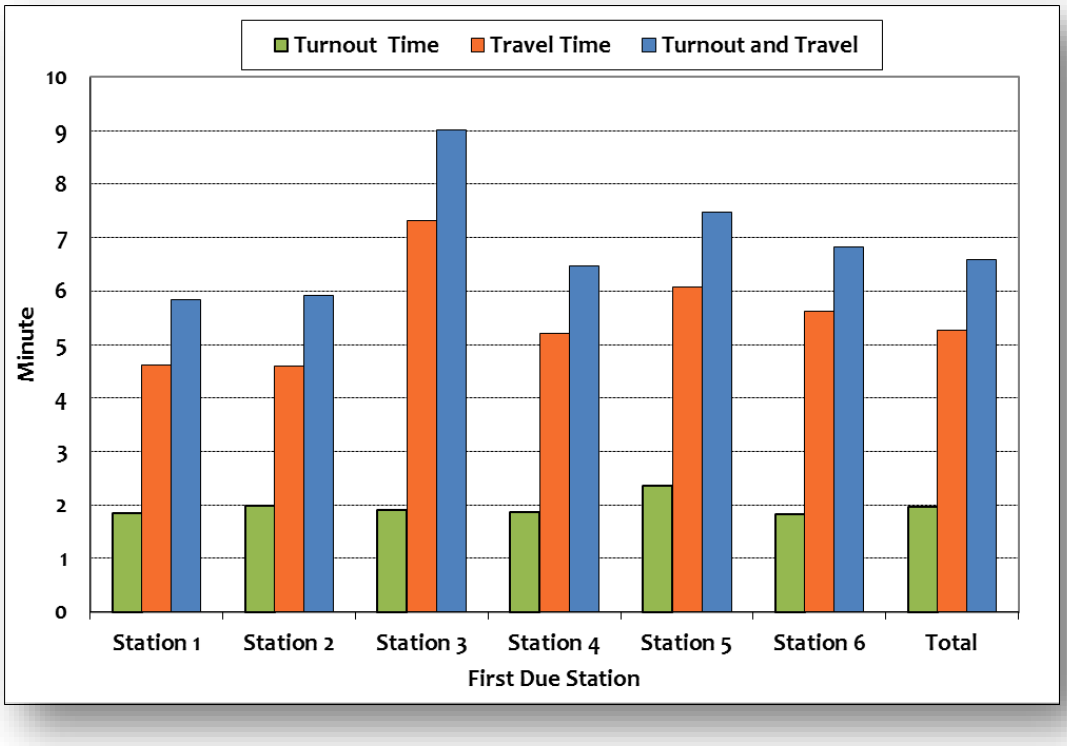
Table 66: Mean First Arrival Performance by First Due Station

First Due Station	Dispatch Time	Turnout Time	Travel Time	Turnout and Travel	Response Time	Sample Size
Station 1	0.8	1.0	2.8	3.8	4.6	1,998
Station 2	0.7	1.1	3.1	4.2	4.9	2,467
Station 3	1.1	1.0	5.1	6.1	7.2	118
Station 4	0.7	1.0	3.4	4.4	5.1	1,074
Station 5	0.7	1.3	4.1	5.4	6.1	1,140
Station 6	0.6	1.1	3.9	5.0	5.6	1,042
Total	**0.7**	**1.1**	**3.4**	**4.4**	**5.2**	**7,839**

Table 67: 90th Percentile First Arrival Performance by Station FDZ

First Due Station	Dispatch Time	Turnout Time	Travel Time	Turnout and Travel	Response Time	Sample Size
Station 1	1.6	1.9	4.6	5.8	6.6	1,998
Station 2	1.4	2.0	4.6	5.9	6.8	2,467
Station 3	2.6	1.9	7.3	9.0	11.1	118
Station 4	1.3	1.9	5.2	6.5	7.3	1,074
Station 5	1.2	2.4	6.1	7.5	8.3	1,140
Station 6	1.2	1.8	5.6	6.8	7.5	1,042
Total	**1.4**	**2.0**	**5.3**	**6.6**	**7.3**	**7,839**

Figure 42: 90th Percentile First Arrival Performance by Station FDZ



The data was further analyzed to compare the individual station FDZ performances. With respect to turnout time, Station 1 had the shortest turnout time at 111 seconds or one minute and 51 seconds. Station 5 calls had the longest turnout time at 141 seconds or two minutes and 21 seconds.

Conversely, when examining the travel time performance, performances for calls in station 3 and 5 were significantly longer than calls in other first due stations. Similarly, since travel time is the single largest indicator of overall response performance, the turnout plus travel time analysis revealed that 90th percentile measurements for calls in first due stations 3 and 5 were significantly longer than calls in the other stations.

Figure 43: 90th Percentile Turnout Time by Station FDZ

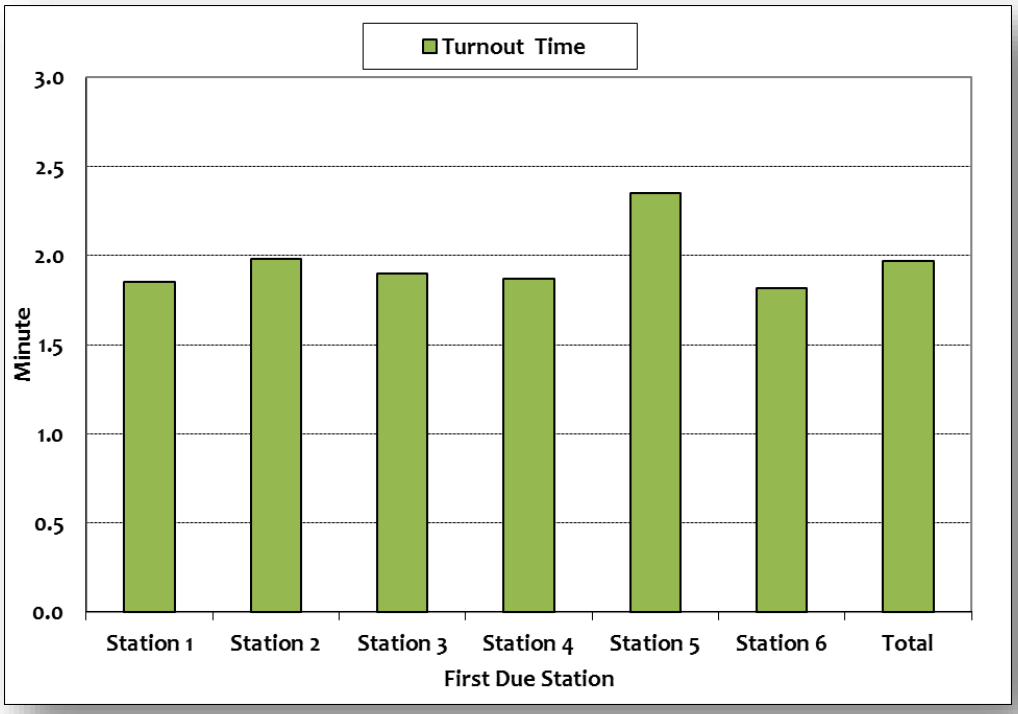


Figure 44: 90th Percentile Travel Time Performance by Station FDZ

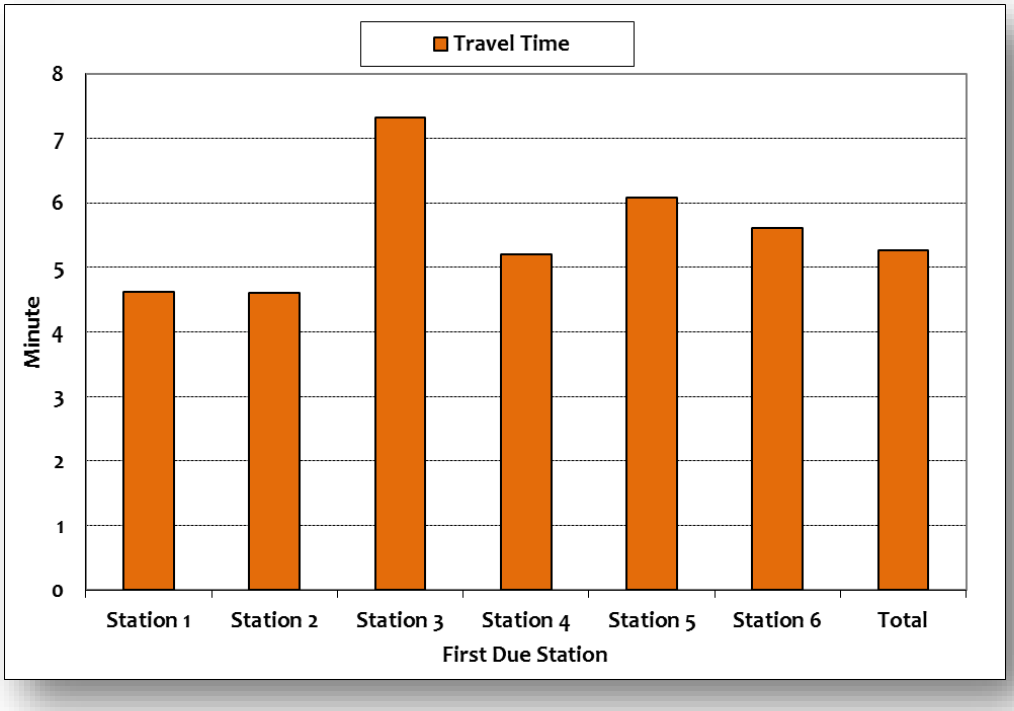


Figure 45: 90th Percentile Turnout and Travel Performance by Station FDZ

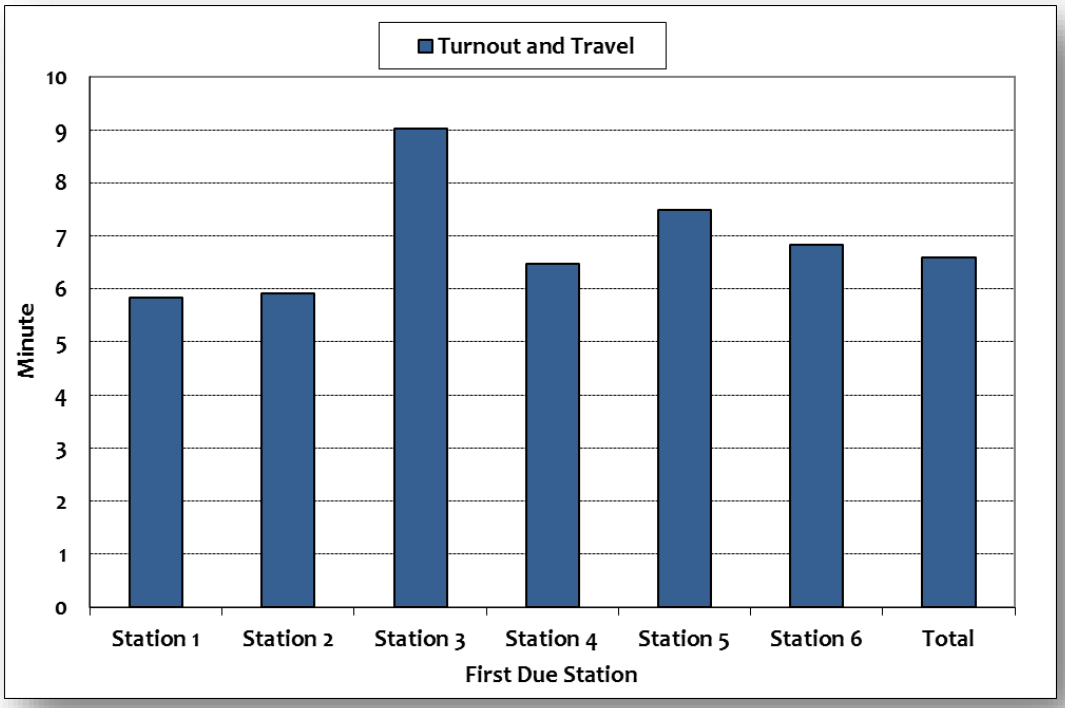
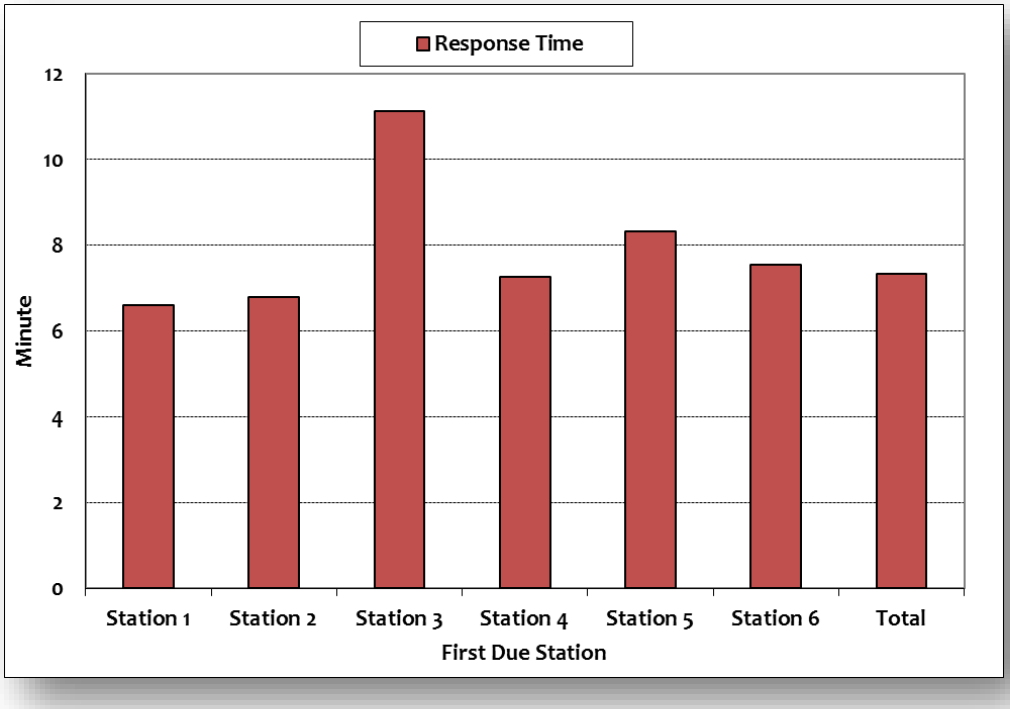


Figure 46: *90th Percentile Response Time Performance by Station FDZ*



Concentration Factors

Concentration of Risks by Demand Zone

Analyses were conducted to describe and measure the relative concentration of risks in each of the fire station demand zones. Therefore, a station demand zone risk matrix was developed to quantitatively evaluate the relative risk by including measures for the frequency of moderate and high risk occupancies in each fire demand zone that are directly correlated to the necessity of higher concentrations of resources. In addition, several measures that both serves the distribution aspect of the risk evaluation, but also contributes to the need for higher concentrations of resources. For example, a higher call volume may serve to drive the need for additional resources to cover the community's demand.

The variables included in the risk matrix are the demand for services for each station demand zone, the number of high and moderate-risk occupancies, and the impact of simultaneous events in each station demand zone. All measures were weighted equally, however, two variables have surrogate relationships with historical community demands and one variable is dedicated to prospective occupancy risk. Community demands were rated more heavily in an effort to provide a realistic balance between the risk potential with historical experience. The risk tool and the scoring template are provided below.

Table 68: Summary of Station Fire Demand Zone Risk Concentration Matrix

Risk Class	Community Demand (CD)		Call Concurrency (CC)		High/Moderate Risk Occupancies (RO)		Total Risk Score
	Value	Scale (Calls)	Value	Scale (%)	Value	Scale (Occupancies)	$\sqrt{\frac{(CD)^2 + (CC)^2 + (RO)^2}{2}}$
High	7 to 9	≥ 2,700	7 to 9	≥ 15	7 to 9	≥ 330	≥ 7
Moderate	4 to 6	≥ 1,350 and < 2,700	4 to 6	≥ 7.5 and < 15	4 to 6	≥ 165 and < 330	≥ 4 and < 7
Low	1 to 3	< 1,350	1 to 3	< 7.5	1 to 3	< 165	< 4

** Definitions for Occupancy Risk Type were provided as part of the full risk assessment previously.*

Table 69: Station Demand Zone Risk Concentration Matrix

Station FDZ	Community Demand	Score	Call Concurrency	Score	High/Moderate Risk	Score	Total Score
1	3,220	8	14.9	6	289	6	8.25
2	3,813	9	18.6	8	231	5	9.22
3	270	1	7.0	3	55	2	2.65
4	1,602	4	9.1	4	173	4	4.90
5	1,808	5	9.9	4	47	1	4.58
6	1,490	4	8.7	4	98	2	4.24

Table 70: Station Deployment and Risk Concentration Summary

Station FDZ	Engine	Ladder	Rescue	Squad	Total Risk Score	Station Risk Concentration Identification
1		1		1[a]	8.25	High
2	1		1[b]		9.22	High
3	1[c]				2.65	Low
4	1				4.90	Moderate
5	1				4.58	Moderate
6	1				4.24	Moderate

Note: a=strategically staffed unit; b=cross staffed unit; c=Single person unit for airport

Wildfire risk was not included in the risk matrices. It is understood that Station 5's territory includes the most risk and if a risk rating were included, it would rise above Station 4 but not qualify for a high-risk station area. This recognition supports later recommendations for station configurations.

Graphic representations of the three axis risk matrices are provided below. When reviewing these radar figures, the larger the shaded area, the greater the risk. In addition, each axis is labeled so that the reader can determine the relationship between the risk drivers for each station area. For example, in Station 1, the demand for services has slightly greater risk than both risk and call concurrency. Overall, Station 1 has a very balanced risk profile.

Similarly, when reviewing Station 5's risk profile, the greatest risk is for the demand followed by call concurrency, while occupancy risk is very low.

Figure 47: Station 1 Risk Profile

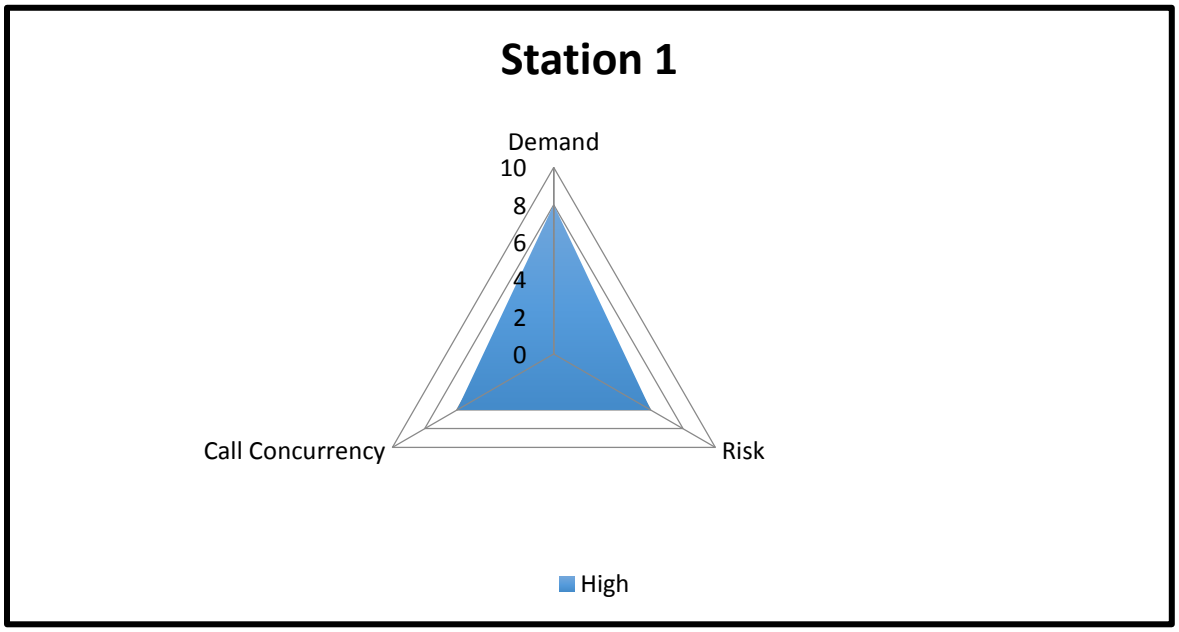


Figure 48: Station 2 Risk Profile

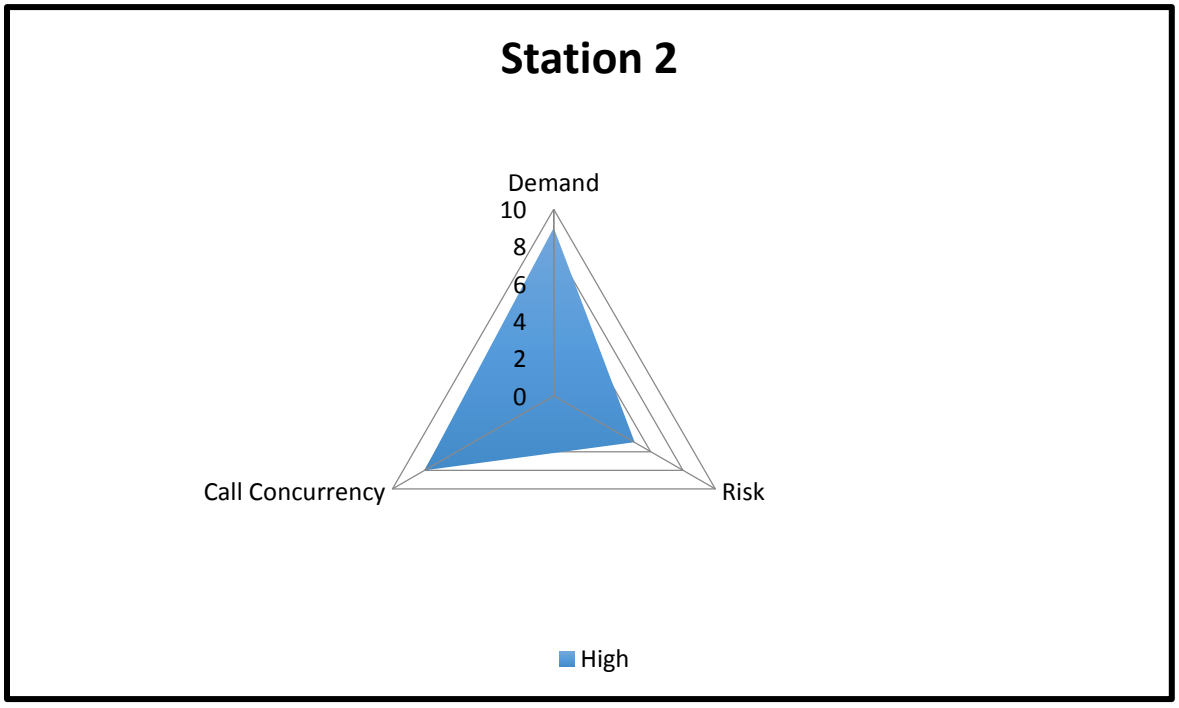


Figure 49: Station 3 Risk Profile

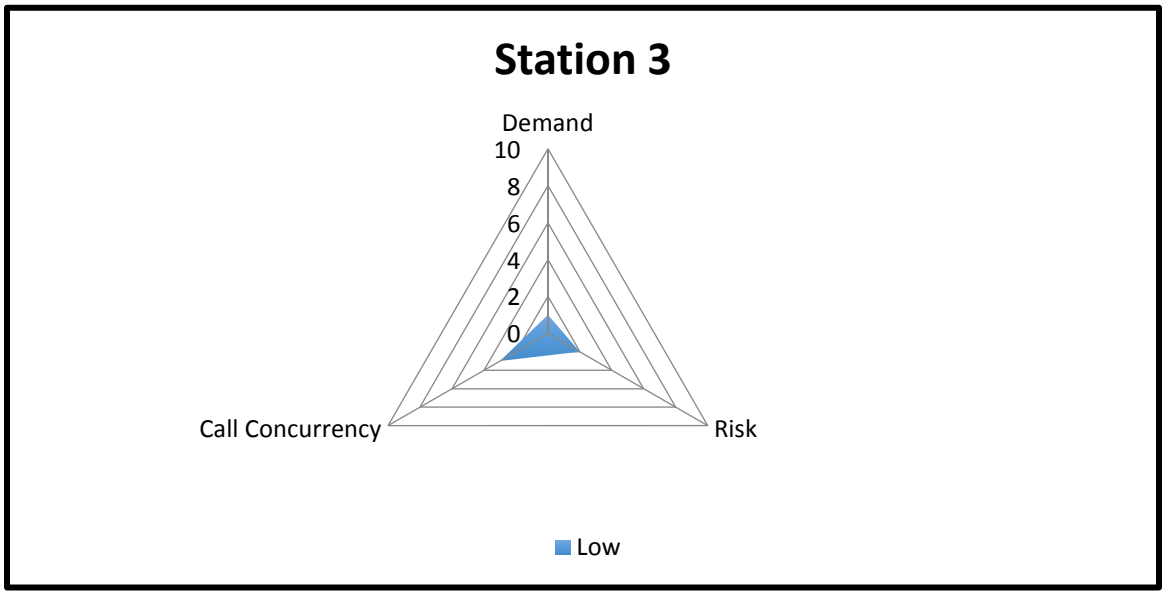


Figure 50: Station 4 Risk Profile

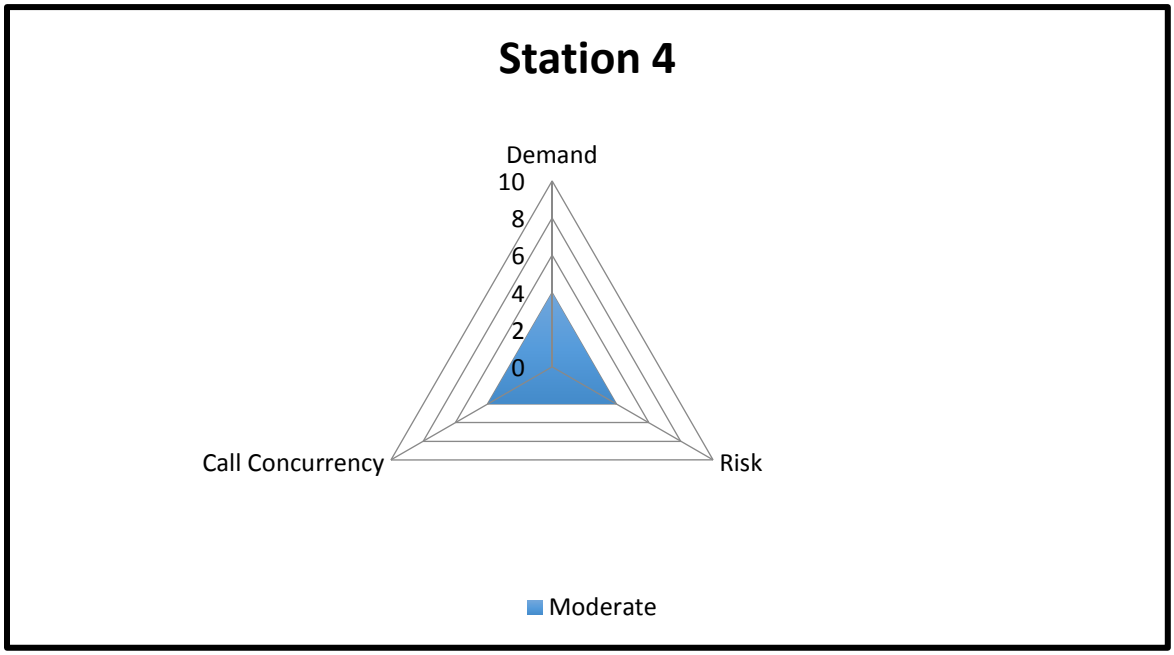


Figure 51: Station 5 Risk Profile

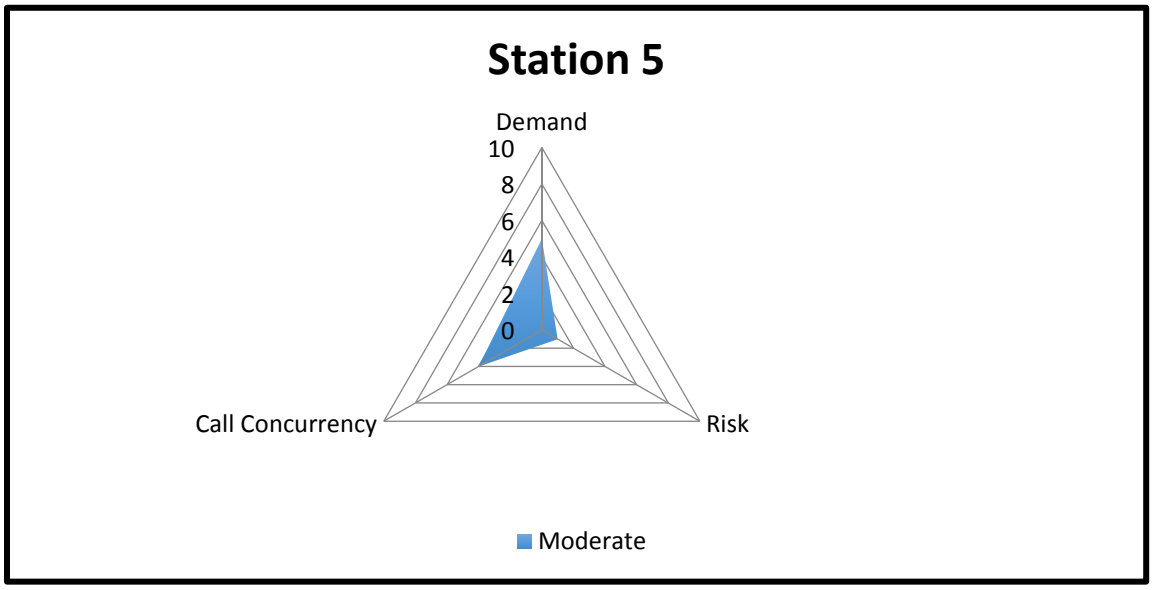
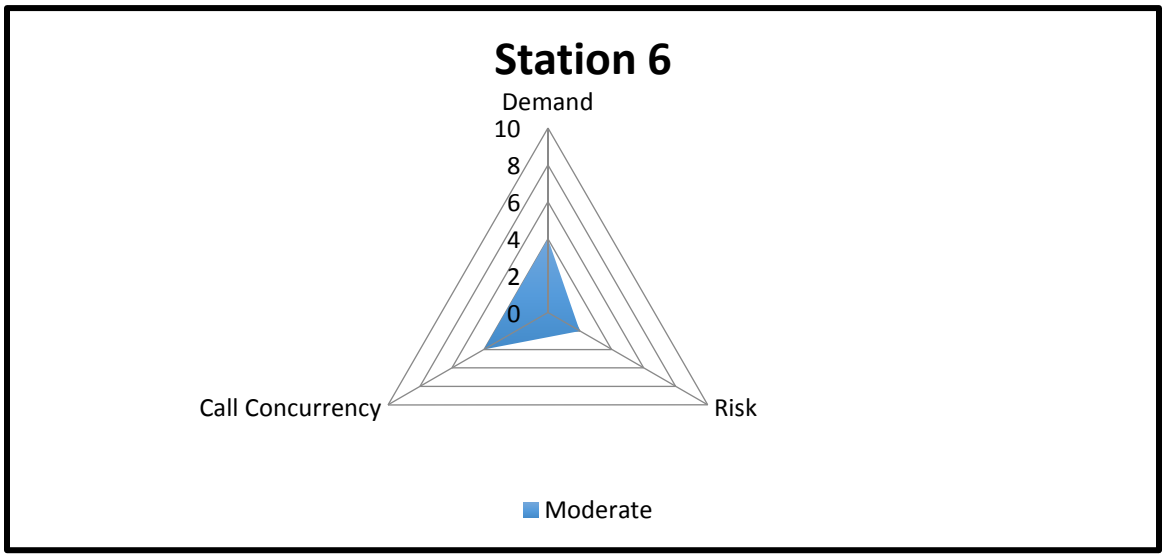


Figure 52: Station 6 Risk Profile



Concentration of Resources

The station fire demand zone risk matrices demonstrate that the risk associated with the Department is generally low in nature and the demand can be appropriately handled within the umbrella of the current distribution model. While Station 3's FDZ remains in this analysis, there is minimal physical station resources that deploys from within the FDZ and Chico Station 5 and County Station 42 retains primary responsibility.

Two high-risk FDZ's are generated from the application of the risk matrix suggesting a greater concentration of resources should be assigned to assist in covering both the inherent risk as well as

the community's demand for services. In general, the distribution model that currently exists is capable of addressing the low and moderate concentrations of risk without increased concentrations of resources. Therefore, the competing demands for where these resources are placed are not necessarily driven by occupancy risk when the potential risk and the historical demand are not congruent.

Effective Response Force Capabilities

The capability of an Effective Response Force (ERF) to assemble in a timely manner with the appropriate personnel, apparatus, and equipment is important to the success of a significant structural fire event. Therefore, it is important to measure the capabilities of assembling an ERF. In most fire departments, the distribution model performs satisfactorily, but it is not uncommon to be challenged to assemble an ERF in the recommended timeframes.

Several factors affect the capabilities to assemble an ERF such as the number of fire stations, number of units, and number of personnel on each unit. Each of these policy decisions should be made in relation to the community's specific risks and the willingness to assume risk. Analyses of historical performance for each station reveal that station demand zones of 1 and 2 meet or exceed best practice recommendations of eight minutes on average. The second arriving units of station demand zones 1, 2, 3, and 6 had average travel time less than or equal to eight minutes[48] [49]. However, please note that 90% of the incidents used in response time analysis had only one CFD unit responding, so the sample size for 2nd, 3rd and 4th arriving units reduced dramatically.

Table 71: Sample Size for ERF Travel Performance Analysis

First Due Station	Sample Size Order of Arrival			
	1	2	3	4
Station 1	1,998	67	30	17
Station 2	2,467	85	49	29
Station 3	118	3	1	1
Station 4	1,074	33	12	8
Station 5	1,140	34	23	12
Station 6	1,042	32	17	8

[48] National Fire Protection Association. (2010). NFPA 1710, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments.* Boston, MA: National Fire Protection Association.
[49] CFAI. (2009). Fire & emergency service self-assessment manual, (8th ed.). Chantilly, Virginia: Author. (page 71)

Table 72: Historical Average Travel Time Performance for ERF by Station FDZ

First Due Station	Order of Arrival			
	1	2	3	4
Station 1	2.8	3.6	4.7	5.7
Station 2	3.1	4.1	5.1	5.8
Station 3	5.1	4.7	7.2	9.0
Station 4	3.4	5.8	5.7	6.2
Station 5	4.1	5.7	8.5	7.8
Station 6	3.9	4.3	5.4	5.6

Figure 53: Mean ERF Travel Performance for Station 1

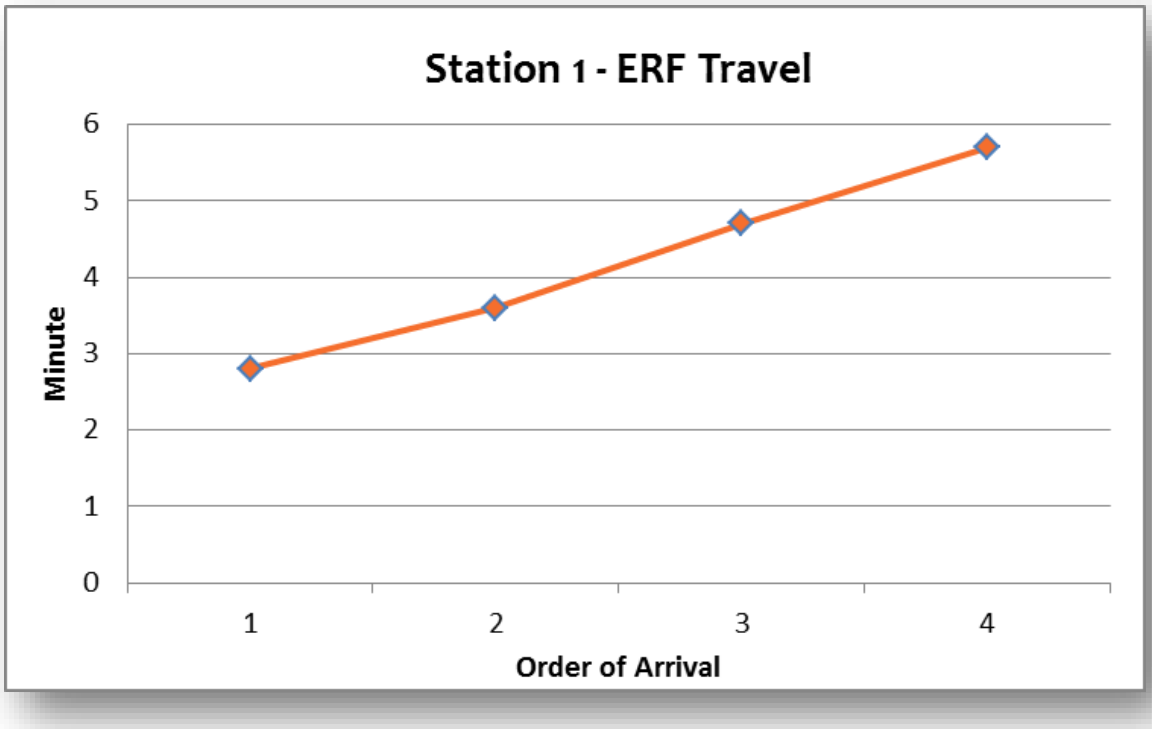


Figure 54: Mean ERF Travel Performance for Station 2

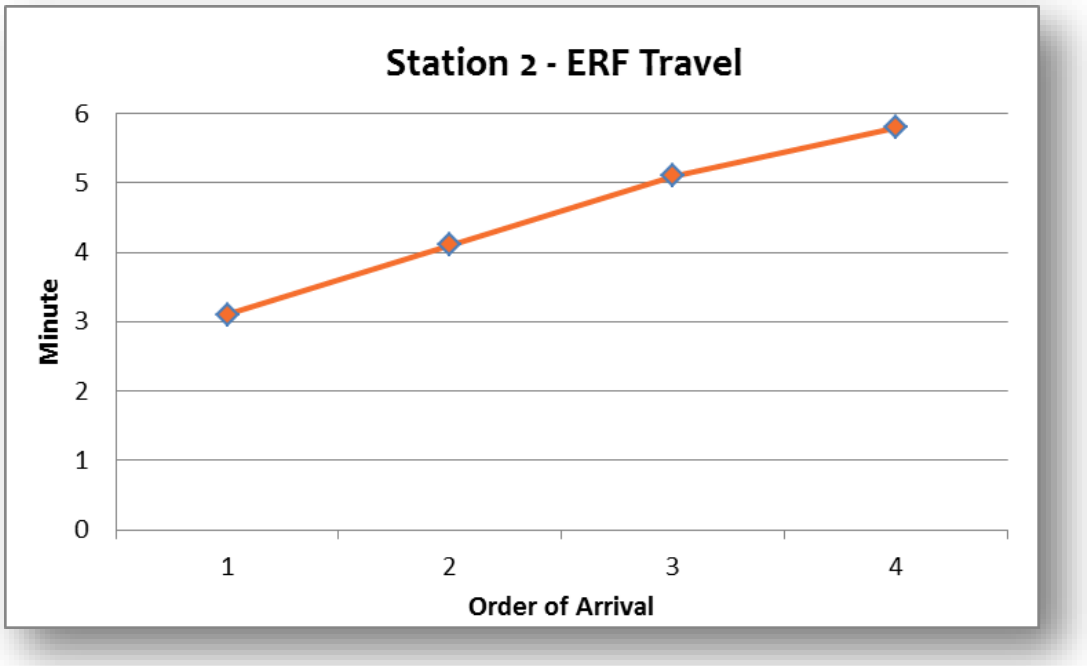


Figure 55: Mean ERF Travel Performance for Station 3

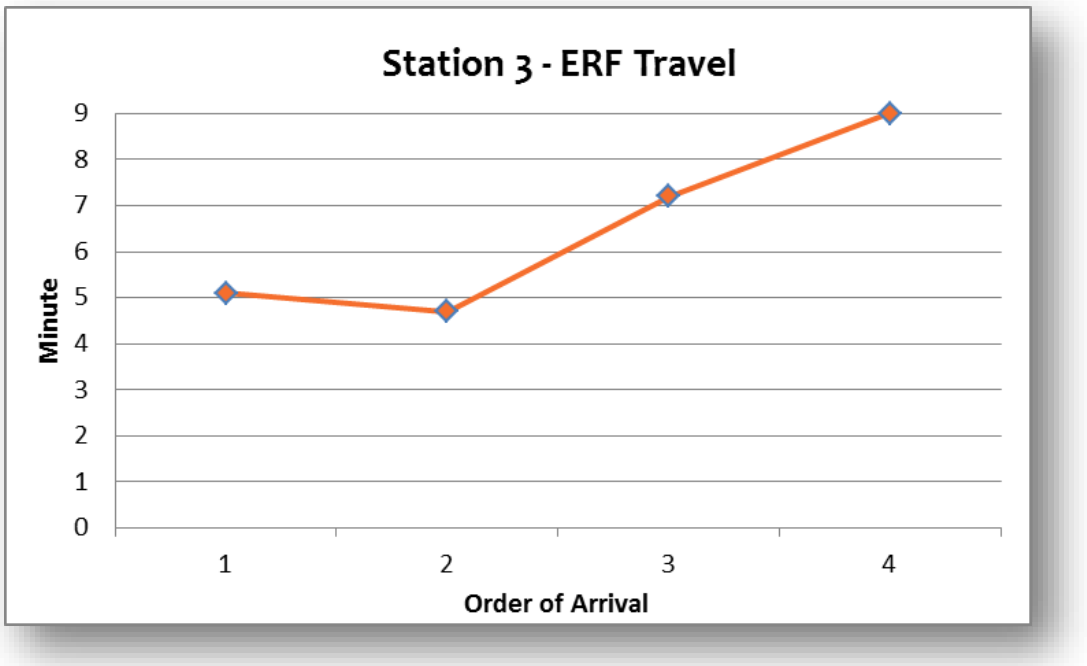


Figure 56: Mean ERF Travel Performance for Station 4

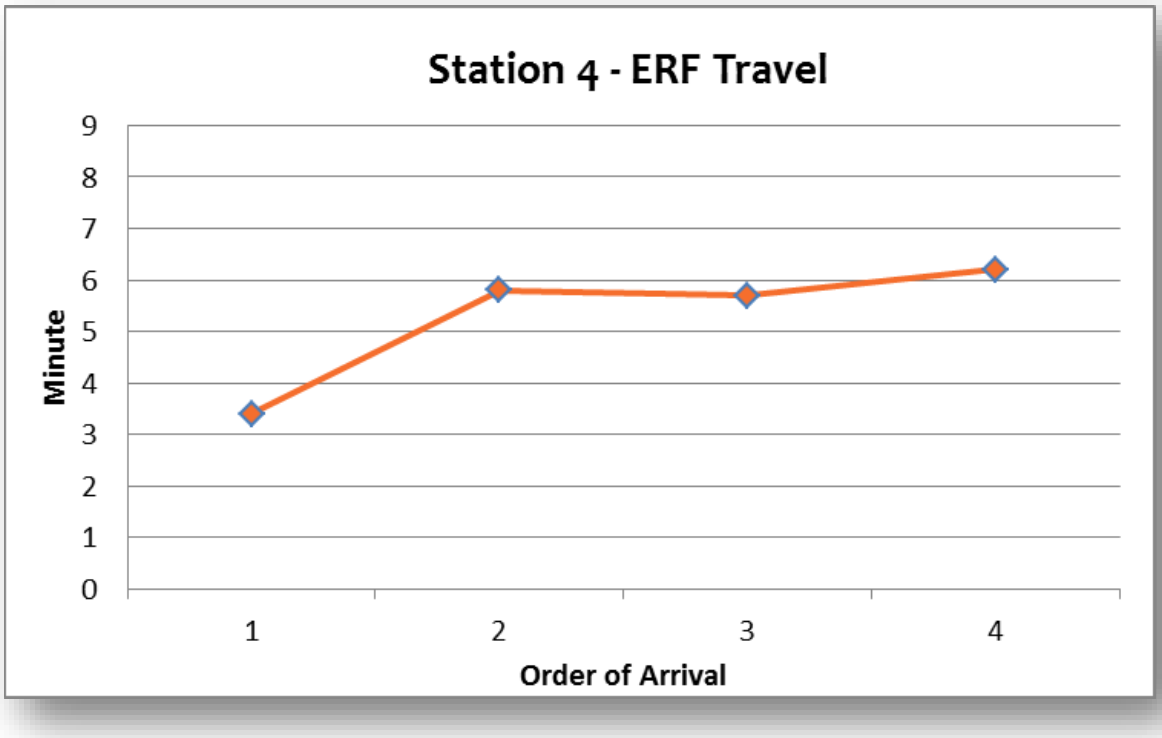


Figure 57: Mean ERF Travel Performance for Station 5

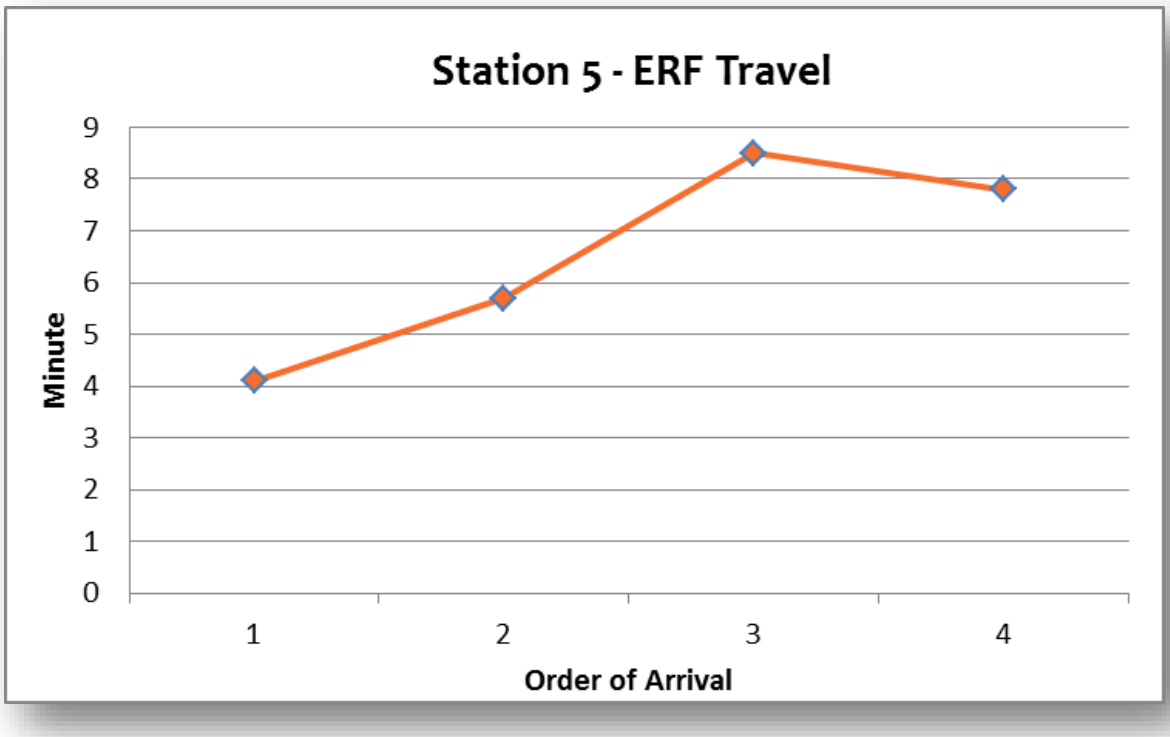
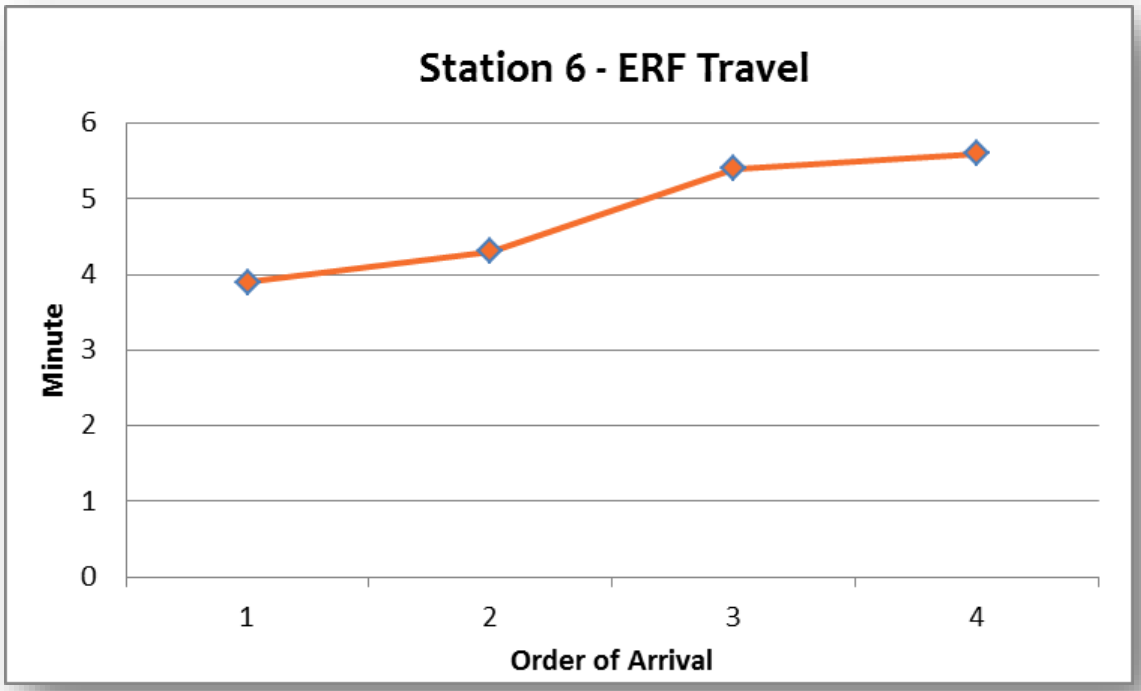


Figure 58: Mean ERF Travel Performance for Station 6



While it is best practice to measure performance to the 90th percentile, it is important to acknowledge that the number of calls drops significantly from the first unit to the second and beyond. For example, in Station 2 the second unit arrived on scene at 85 incidents, the third unit arrived on scene at 49 incidents, and then 29 incidents respectively. The low frequency of occurrences introduces more variability in the data as observed with the previous figures. The 2015 data is presented below.

Table 73: Historical 90th Percentile Travel Time Performance for ERF by Station FDZ

First Due Station	Order of Arrival			
	1	2	3	4
Station 1	4.6	5.6	5.5	7.6
Station 2	4.6	5.6	6.5	7.7
Station 3	7.3	5.5	7.2	9.0
Station 4	5.2	8.5	6.9	9.9
Station 5	6.1	9.8	15.9	8.6
Station 6	5.6	6.3	9.4	9.6

Figure 59: 90th Percent ERF Travel Performance for Station 1

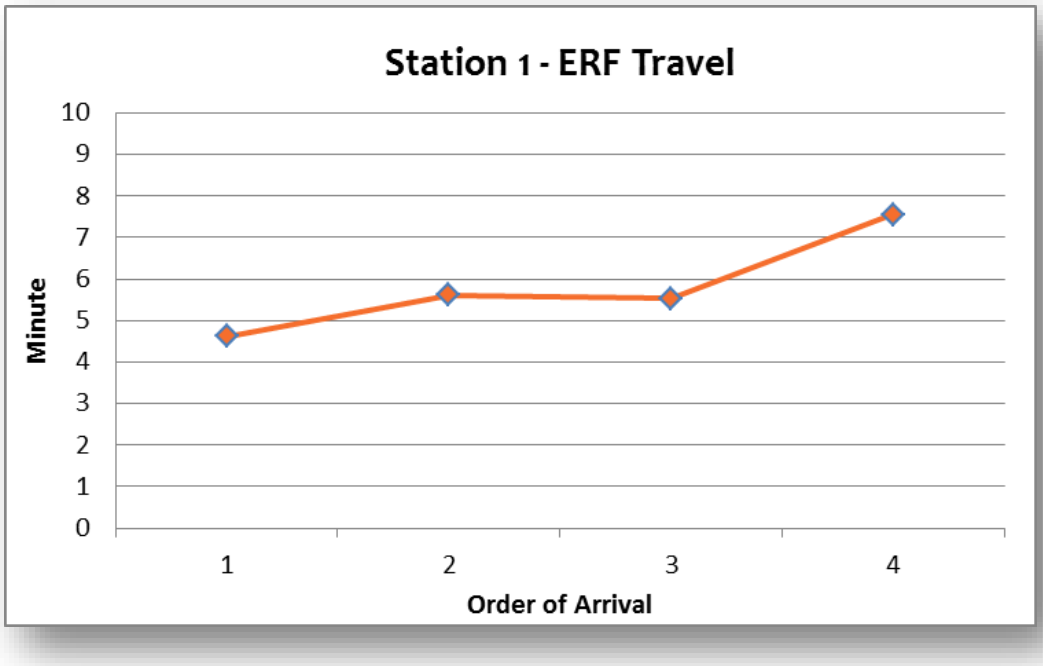


Figure 60: 90th Percent ERF Travel Performance for Station 2

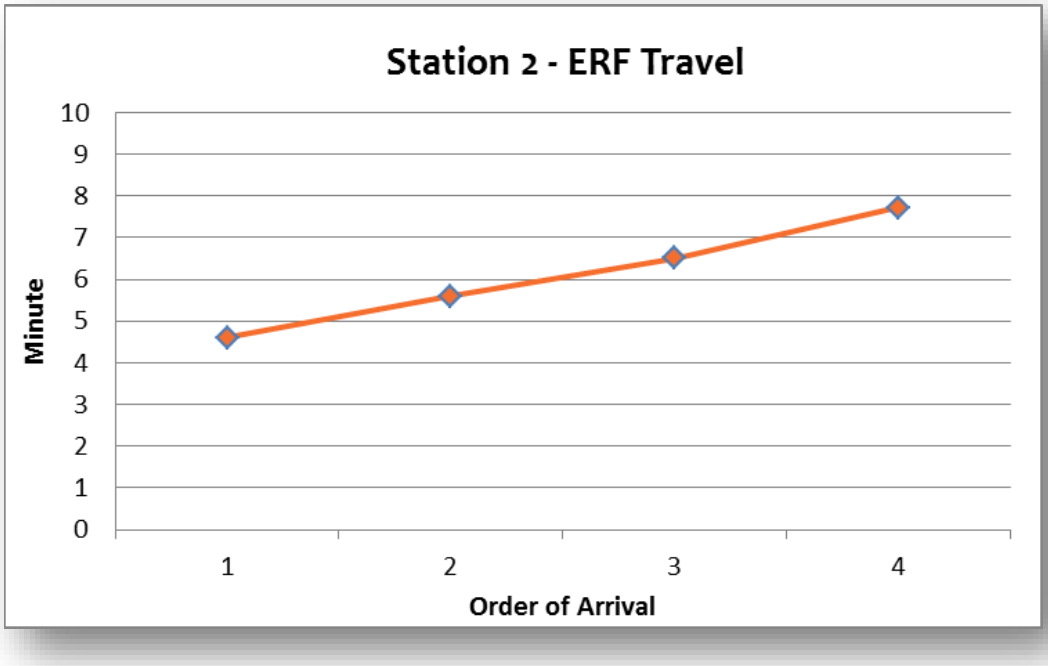


Figure 61: 90th Percent ERF Travel Performance for Station 3

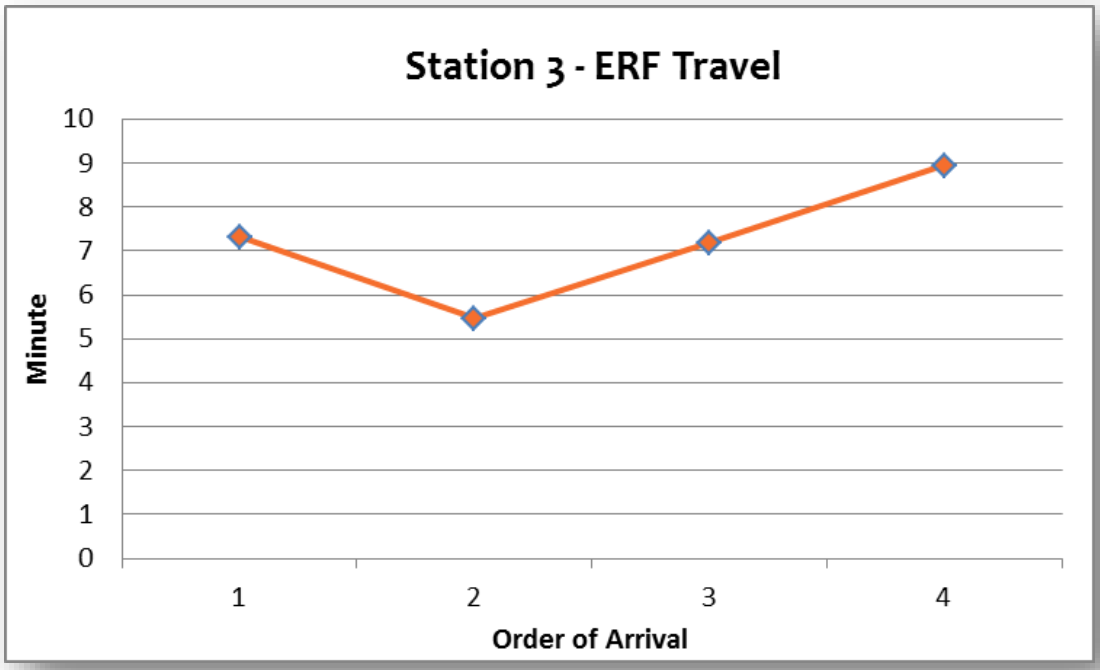


Figure 62: 90th Percent ERF Travel Performance for Station 4

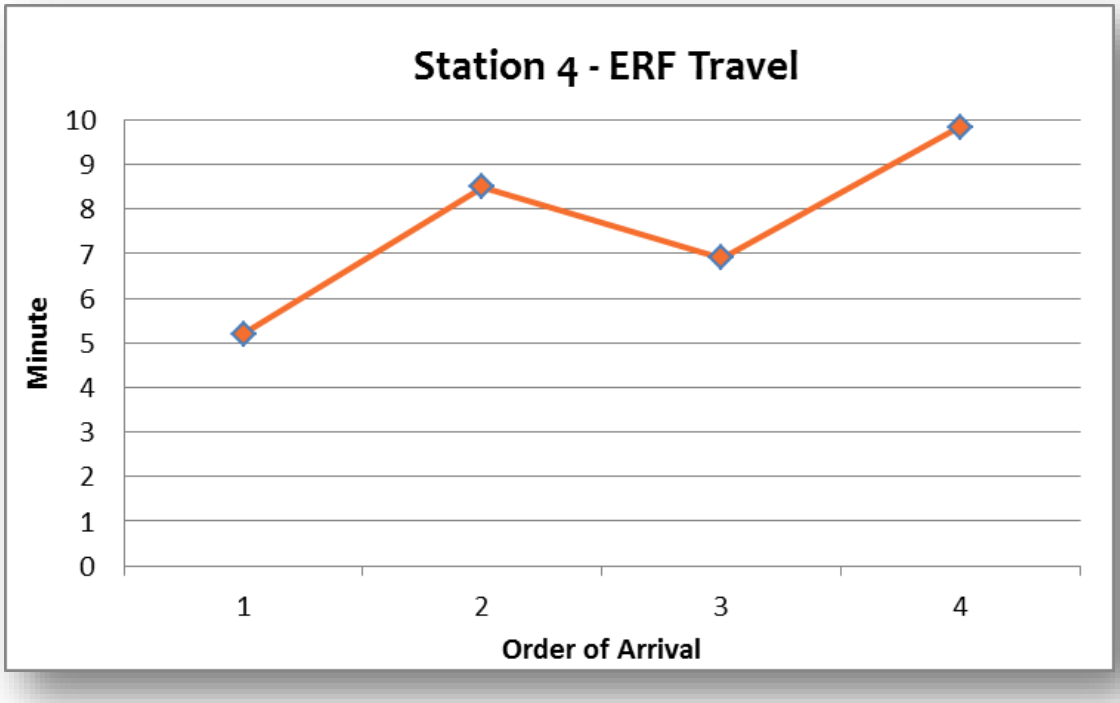


Figure 63: 90th Percent ERF Travel Performance for Station 5

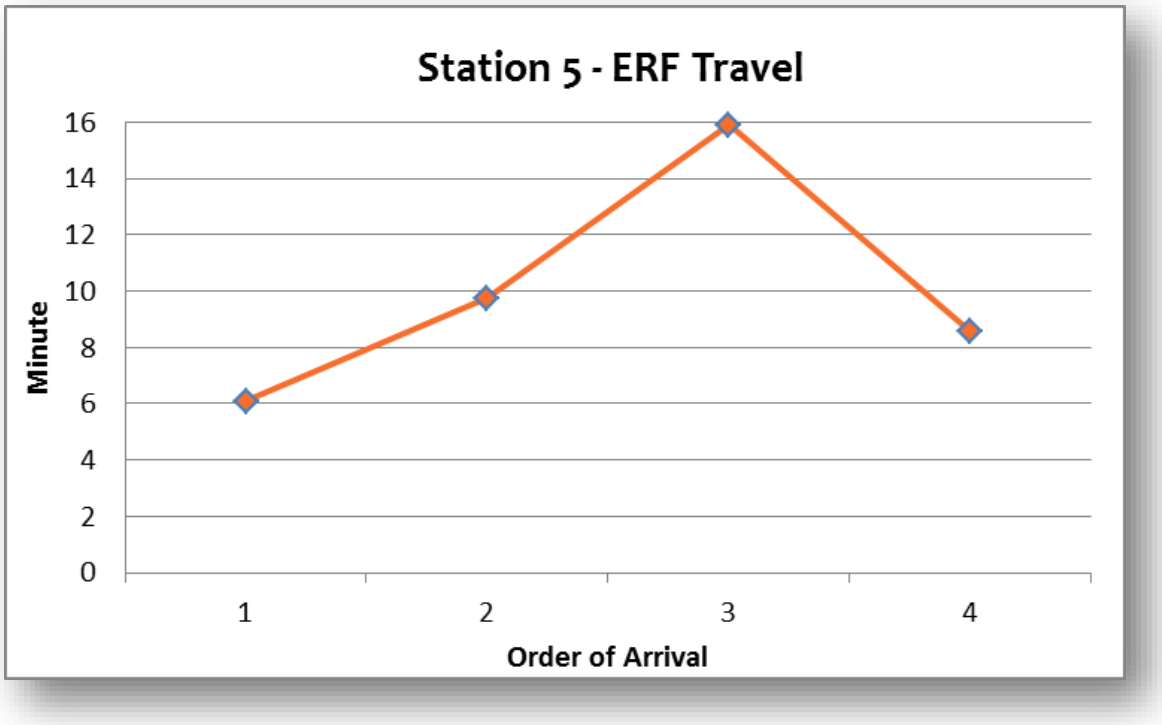
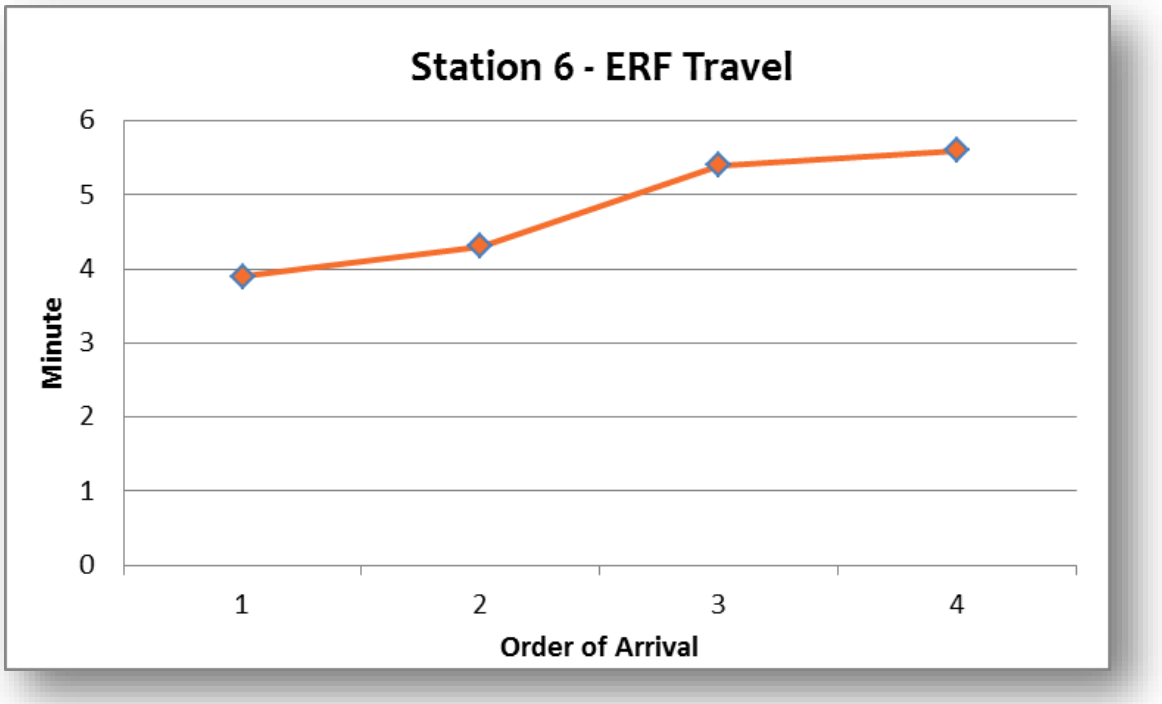


Figure 64: 90th Percent ERF Travel Performance for Station 6



Response Time performance by Available Vehicles

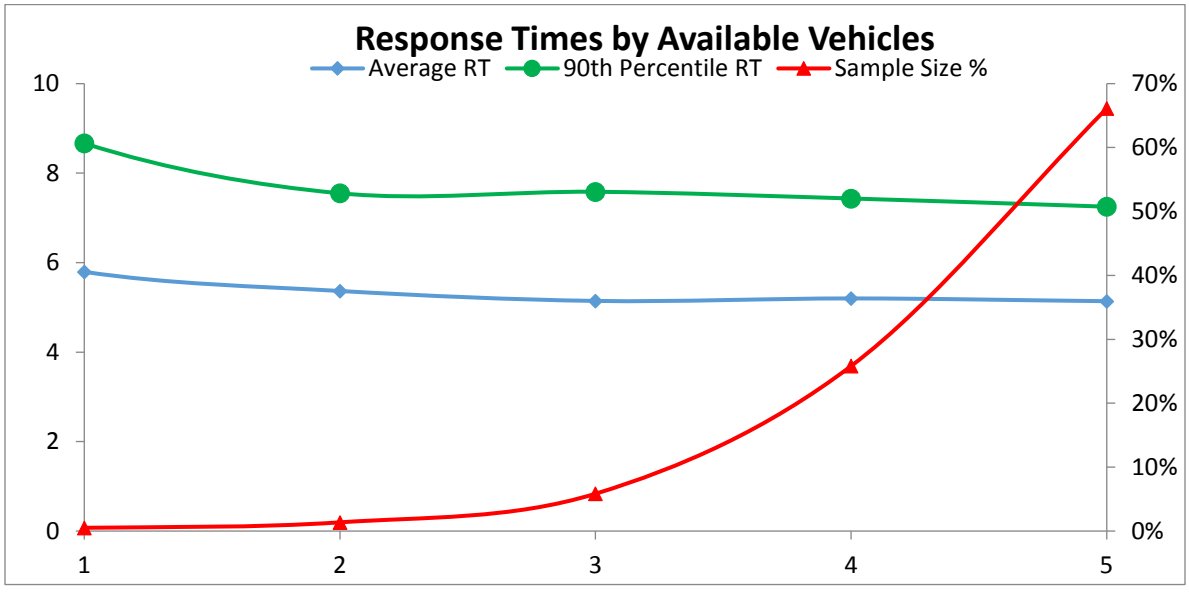
We also investigated whether the response time performance deteriorated when there were fewer vehicles available using 2015 data. In this analysis, admin and utility vehicles were excluded as well as Squad 1 and Engine 3. We assume the department has constantly staffed five units (T1 in station 1, E2 or R2 in station 2, E4 in station 4, E5 in station 5, and E6 in station 6). For 92% of the time, CFD had 4 or 5 units available to be dispatched. Approximately 2% of the time CFD had 2 or less units available. The data suggests that the department does not have a limited resource constraint in terms of average response time performance.

Table 74: Average Response Time by Available Vehicles

No. of Available Vehicles	Average				Sample Size	Percent of Calls
	Dispatch Time	Turnout Time	Travel Time	Response Time		
5	0.7	1.1	3.3	5.1	5,185	66%
4	0.8	1.0	3.4	5.2	2,025	26%
3	0.8	0.9	3.5	5.1	458	6%
2	0.9	0.8	3.7	5.4	107	1%
1	0.8	0.9	4.1	5.8	40	1%
0	1.9	0.7	4.5	7.1	27	0%

Note: Squad 1 is not staffed consistently and E3 does not typically participate other than as a safety officer and were excluded from this analysis.

Figure 65: Average Response Time by Available Vehicles



Reliability Factors

Percentage of Department Compliance

The first step in assessing the reliability of the deployment model or system performance is to understand the department's availability to handle the requests for service that occur within the department's jurisdiction. Chico Fire Department responds to a total of 493 non-canceled calls in the County. County units E41, E42 and E44 stationed in County stations 41, 42 and 44 and other County units have responded to a total of 2,948 calls in Chico, among which 2,711 (92%) calls had no Chico unit responding. Chico Fire Department is available to respond to 78% of the requests for service that are originating within the jurisdiction. We broke down the 493 Mutual/Auto Aid calls into more granular call categories using the CAD descriptions. A total of 33 were structure, outside or vehicle fires. On average, County units responded to 8.1 calls per day in Chico, and 79% of those calls were EMS related requests, and 102 were structure, outside or vehicle fires.

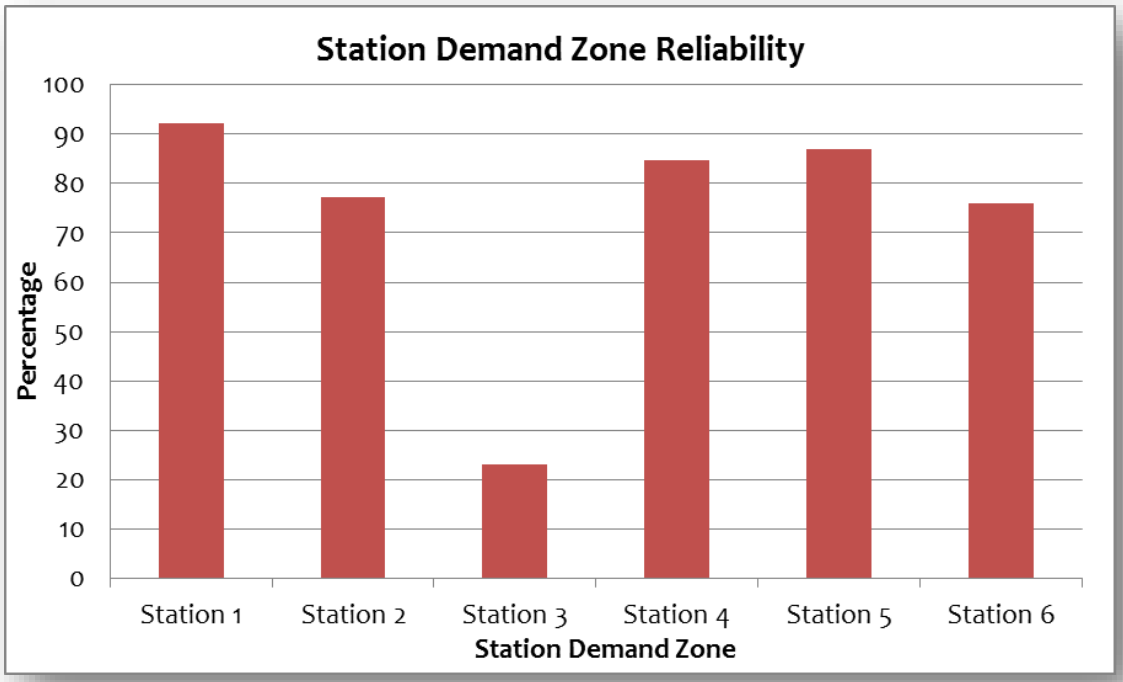
Table 75: Mutual/Auto Aid Interaction between Chico and County Units

Scenario	Chico Units Responding to County Calls	County Units Responding to Chico Calls		
Call Category	Number of Calls	Number of Calls (No Chico Unit)	Number of Calls (Together with Chico Units)	Total
Cardiac and stroke	22	218	4	222
Seizure and unconsciousness	13	262	3	265
Breathing difficulty	21	259	7	266
Overdose and psychiatric	3	64	1	65
MVA	38	127	45	172
Fall and injury	30	365	3	368
Illness and other	236	958	10	968
EMS Total	**363**	**2,253**	**73**	**2,326**
Structure fire	18	5	49	54
Outside fire	11	8	23	31
Vehicle fire	4	9	8	17
False alarm	7	131	15	146
Good intent	0	21	9	30
Public service	33	234	5	239
Fire other	42	41	31	72
Fire Total	**115**	**449**	**140**	**589**
Rescue	**3**	**1**	**1**	**2**
Hazmat	**12**	**8**	**23**	**31**
Total	**493**	**2,711**	**237**	**2,948**

Percentage of First Due Compliance

The reliability of the distribution model is a factor of how often the response model is available and able to respond to the call within the assigned demand zone. If at least one unit from the first due station is able to respond to a call, we consider the station is able to respond to the call within the assigned demand zone. Utilizing the Fire Station Demand Zones (FDZ), analyses reveal that station 1 was capable of meeting their demand for services at the 90th percentile. In other words, when a request for service is received all stations are available to answer the call nine out of 10 times. Station 3 had the lowest reliability of 23%. Station 1 had the highest reliability at 92.3 percent. This analysis utilized all dispatched calls within the jurisdiction and the performance included all assigned units to the specific FDZ.

Figure 66: Percentage Reliability by Station FDZ



Overlapped or Simultaneous Call Analysis

Overlapped calls are defined as the rate at which another call was received for the same first due station while there were one or more ongoing calls in the same first due station. For example, if there is one call in station 1's zone, before the call was cleared another request in station 1's zone occurred and those two calls would be captured as overlapped calls. Some studies also refer as simultaneous calls. Understanding the probability of overlapped or simultaneous calls occurs will help to determine the number of units to staff for each station. In general, the larger the call volume a first due station has, it is more likely to have overlapped or simultaneous calls. The distribution of the demand throughout the day will impact the chance of having overlapped or simultaneous calls.

The duration of a call will also have major influences, since the longer the time it takes to clear a request, the more likely to have an overlapped request.

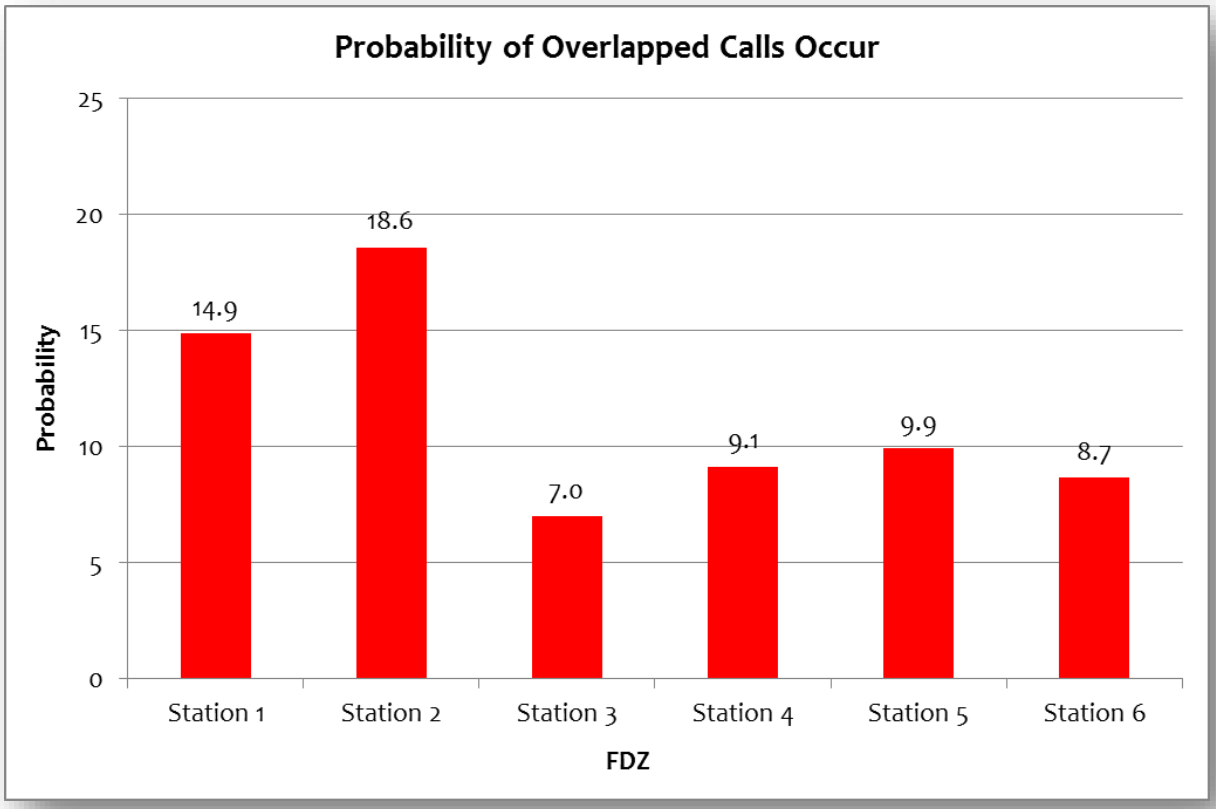
CFD Station 2 has the highest probability of having overlapped calls at 18.6% since it has the highest number of calls of all six demand zones, followed by station 1 at 14.9%, and the other four stations had the probability of overlapped calls occurring less than 10% of the time.

Results are presented below.

Table 76: Overlapped Calls for 2014 by First Due Station

First Due Station	Overlapped Calls	Total Calls	Probability of Overlapped Calls Occur
Station 1	372	2,501	14.9
Station 2	573	3,082	18.6
Station 3	14	200	7.0
Station 4	118	1,290	9.1
Station 5	144	1,450	9.9
Station 6	107	1,234	8.7

Figure 67: Probability of Overlapped Calls Occur by Station FDZ



BASELINE PERFORMANCE TABLES

From 2013 to 2015, the total number of calls was from 10,373 to 10,738 or the average number of calls CFD has responded to range from 28.4 to 29.4. The total unit responses were from 12,692 (in 2014) to 13,409 (in 2015), or 34.8 unit responses per day to 36.7 unit response per day. The figures below present the overall demand and CFD's workload.

Table 77: Number of Incidents Dispatched by Category and Year

Call Category	Number of Calls		
	2013	2014	2015
Cardiac and stroke	722	635	590
Seizure and unconsciousness	729	833	894
Breathing difficulty	712	645	653
Overdose and psychiatric	370	401	376
MVA	509	545	601
Fall and injury	870	986	1,032
Illness and other	2,397	2,596	2,678
EMS Total	**6,309**	**6,641**	**6,824**
Structure fire	77	78	92
Outside fire	252	291	268
Vehicle fire	25	21	26
False alarm	528	502	436
Good intent	78	114	98
Public service	686	634	727
Fire other	336	273	312
Fire Total	**1,982**	**1,913**	**1,959**
Rescue	20	18	11
Hazmat	65	88	86
Mutual/Auto Aid	571	541	493
Canceled	1,426	1,270	1,365
Total	**10,373**	**10,471**	**10,738**
Calls per Day	**28.4**	**28.7**	**29.4**

Figure 68: Number of Calls, Number of Responses, and Total Busy Time by Year

Year	Number of Calls	Number of Responses	Average Responses per Call	Total Busy Hours	Average Busy Minutes per Response
2013	10,373	12,983	1.3	3,896	18.0
2014	10,471	12,692	1.2	3,234	15.3
2015	10,738	13,409	1.2	3,669	16.4

The figures below represent the baseline response performance for EMS and fire incidents. We do not report rescue and hazmat incidents due to their small sample sizes. Since 91% of the EMS incidents only had one dispatched CFD unit, we only report the first arriving unit for EMS incidents. For fire category calls, 17% incidents had second arriving unit, thus we report the performances of 2nd arriving units as ERF for the fire category calls.

For EMS calls, in the past three years, the average dispatch time was 36 seconds or 0.6 minutes. The average turnout and travel time was 264 seconds or four minutes and 24 seconds, and the average

response time was 300 seconds or five minutes. For fire category calls, in the past three years, the average dispatch time was 48 seconds. The average turnout and travel time of the first arriving unit was 300 seconds and the average response time was 342 seconds. The average turnout and travel time of the ERF unit or second arriving unit was 378 seconds, which is 78 seconds longer than the first arriving unit. The average response time of the ERF unit or second arriving unit was 438 seconds, which is 96 seconds longer than the first arriving unit.

Table 78: Baseline Performance for EMS Incidents -2013/2015

EMS (Lights and Sirens) Average Time - 1st Arriving Unit		2013 - 2015	2015	2014	2013
Alarm Handling	Call Entry to Dispatch	0.6	0.7	0.7	0.4
Turnout Time	Turnout Time	1.1	1.0	1.0	1.4
Travel Time	Travel Time	3.3	3.3	3.3	3.2
Turnout and Travel Time	Turnout and Travel Time	4.4	4.3	4.3	4.5
Response Time	Call Entry to Onscene	5.0	5.0	5.0	5.0
Sample Size	1st Arriving Unit	19,012	6,592	6,315	6,105

Table 79: Baseline Performance for Fire Incidents -2013/2015

Fire (Lights and Sirens) Average Time		2013 - 2015	2015	2014	2013
Alarm Handling	Call Entry to Dispatch	0.8	0.9	0.8	0.6
Turnout Time	Turnout Time - 1st Unit	1.4	1.2	1.2	1.7
Travel Time	Travel Time - 1st Unit	3.6	3.7	3.7	3.4
	Travel Time - ERF (2nd Unit)	4.6	4.1	5.0	4.5
Turnout and Travel Time	Turnout and Travel Time - 1st Unit	5.0	5.0	4.9	5.0
	Turnout and Travel Time - ERF (2nd Unit)	6.3	5.6	6.5	6.6
Response Time	Call Entry to Onscene - 1st Unit	5.7	5.8	5.8	5.6
	Call Entry to Onscene - ERF (2nd Unit)	7.3	6.8	7.7	7.3
Sample Size	1st Unit	3,714	1,171	1,242	1,301
	ERF (2nd Unit)	595	156	153	286

We also summarized 90th percentile performances for the 1st arriving and ERF units for EMS and fire incidents separately. For EMS calls, in the past three years, the 90th percentile dispatch time was 72 seconds. The 90th percentile turnout and travel time was 385 seconds (6 minutes and 25 seconds). The 90th percentile response time was 424 seconds (7 minutes and 4 seconds). Please note that the 90th percentile response time is not the same as adding 90th percentile dispatch time and 90th percentile turnout and travel time.

For fire suppression calls, in the past three years, the 90th percentile dispatch time was 92 seconds (1 minute and 32 seconds). The 90th percentile turnout and travel time of the first arriving unit was 434 seconds (7 minutes and 14 seconds). The 90th percentile response time of the first arriving unit was 488 seconds (8 minutes and 8 seconds). The 90th percentile turnout and travel time of the ERF unit or second arriving unit was 510 seconds (8 minutes and 30 seconds), which was 76 seconds longer

than the first arriving unit. The 90th percentile response time of the ERF unit or second arriving unit was 563 seconds (9 minutes and 23 seconds), which was 75 seconds longer than the first arriving unit.

The department can reference the historical performances and make reasonable targets to continuously improve the response process to meet recommended targets by industry standards or best practices

Table 80: Summary of 90th Percentile Performance for EMS (BLS/ALS) Incidents – 2013/2015

EMS (Lights and Sirens) 90th Percentile Time - 1st Arriving Unit		2013 - 2015	2015	2014	2013
Alarm Handling	Call Entry to Dispatch	1.2	1.3	1.3	0.9
Turnout Time	Turnout Time	2.0	1.9	1.8	2.2
Travel Time	Travel Time	5.1	5.1	5.2	4.9
Turnout and Travel Time	Turnout and Travel Time	6.4	6.4	6.4	6.5
Response Time	Call Entry to Onscene	7.1	7.2	7.1	6.9
Sample Size	1st Unit	19,012	6,592	6,315	6,105

Table 81: Summary of 90th Percentile Performance for Fire Incidents – 2013/2015

Fire (Lights and Sirens) 90th Percentile Time		2013 - 2015	2015	2014	2013
Alarm Handling	Call Entry to Dispatch	1.5	1.7	1.6	1.3
Turnout Time	Turnout Time - 1st Unit	2.3	2.2	2.0	2.6
Travel Time	Travel Time - 1st Unit	5.8	6.0	5.8	5.4
	Travel Time - ERF (2nd Arriving Unit)	6.6	6.0	7.3	6.7
Turnout and Travel Time	Turnout and Travel Time - 1st Unit	7.2	7.4	7.1	7.2
	Turnout and Travel Time - ERF (2nd Unit)	8.5	7.7	8.8	8.6
Response Time	Call Entry to Onscene - 1st Unit	8.1	8.4	8.1	7.9
	Call Entry to Onscene - ERF (2nd Unit)	9.4	8.7	10.0	9.4
Sample Size	1st Unit	3,714	1,171	1,242	1,301
	ERF (2nd Unit)	595	156	153	286

PERFORMANCE OBJECTIVES AND MEASUREMENT

Performance Objectives – Benchmarks

Fire Suppression Services Program

For 90 percent of all structure fires, the total response time for the arrival of the first-due unit, staffed with 2 firefighters and 1 officer, shall be: 7 minutes and 30 seconds in all areas. The first-due unit for all risk levels shall be capable of: providing 500 gallons of water and 1,500 gallons per minute (gpm) pumping capacity; initiating command; requesting additional resources; establishing a back-up line and advancing an attack line, each flowing a minimum of 150 gpm; establishing an uninterrupted water supply; containing the fire; rescuing at-risk victims; and performing salvage operations. These operations shall be done in accordance with departmental standard operating procedures while providing for the safety of responders and the public.

For 90 percent of all moderate structure fires, the total response time for the arrival of the effective response force (ERF), staffed with 13 firefighters and officers, shall be: 10 minutes in all areas. The ERF shall be capable of: establishing command; appointing a site safety officer; providing an uninterrupted water supply; advancing an attack line and a backup line for fire control; complying with the Occupational Safety and Health Administration (OSHA) requirements of two- in and two-out; completing forcible entry; searching and rescuing at-risk victims; ventilating the structure; controlling utilities; and performing salvage and overhaul. These operations shall be done in accordance with departmental standard operating procedures while providing for the safety of responders and the general public.

Emergency Medical Services Program

For 90 percent of all EMS responses, the total response time for the arrival of the first-due unit, staffed with a minimum of 2, shall be: 6 minutes and 30 seconds in all areas. The first-due unit shall be capable of: assessing scene safety and establishing command; sizing-up the situation; conducting an initial patient assessment; obtaining vitals and patient's medical history; initiating mitigation efforts within one minute of arrival; providing first responder medical aid including automatic external defibrillation (AED); and assisting transport personnel with packaging the patient.

The department relies upon Butte County Ambulance, a third-party provider, to complete the effective response force (ERF) component of its EMS program. The initial arriving fire department company shall have the capabilities of providing first responder medical aid including AED, until the third-party provider arrives on scene. If the third-party provider unit arrives on scene first, its personnel shall initiate care and the staff from the initial fire department company shall provide support as needed.

Hazardous Materials Services Program

For 90 percent of all hazardous materials response incidents, the total response time for the arrival of the first-due unit, staffed with 2 firefighters and 1 officer, shall be: 7 minutes and 30 seconds in all areas. The first-due unit shall be capable of: establishing command; sizing up and assessing the situation to determine the presence of a potential hazardous material or explosive device; determining the need for additional resources; estimating the potential harm without intervention; and begin establishing a hot, warm, and cold zone.

For 90 percent of all moderate hazardous materials response incidents, the total response time for the arrival of the effective response force (ERF) including the hazardous materials response team, staffed with 12 firefighters and officers, shall be: 15 minutes in all areas. The ERF shall be capable of: appointing a site safety officer; and providing the equipment, technical expertise, knowledge, skills, and abilities to mitigate a hazardous materials incident in accordance with department standard operating guidelines.

Rescue Services Program

For 90 percent of all technical rescue incidents, the total response time for the arrival of the first-due unit, staffed with 2 firefighters and 1 officer, shall be: 7 minutes and 30 seconds in all areas. The first-due unit shall be capable of: establishing command; sizing up to determine if a technical rescue response is required; requesting additional resources; and providing basic life support to any victim without endangering response personnel.
For 90 percent of all technical rescue incidents, the total response time for the arrival of the effective response force (ERF), staffed with 10 firefighters and officers including the technical response team, shall be: 15 minutes all areas. The ERF shall be capable of: appointing a site safety officer; establishing patient contact; staging and apparatus set up; providing technical expertise, knowledge, skills, and abilities during technical rescue incidents; and providing first responder medical support.

Summaries of the Department's benchmarks objectives are presented below.

Table 82: Summary of Chico Fire Department's Benchmark Objectives

Measured at the 90th Percentile		Suppression	BLS	HazMat	Tech Rescue
Call Processing	Pick-up to Dispatch	1:00	1:00	1:00	1:00
Turnout	Turnout Time 1st Unit	1:30	1:00	1:30	1:30
	Turnout Time for ERF	1:30	1:00	1:30	1:30
Travel	Travel Time 1st Due	6:00	6:00	6:00	6:00
	Travel Time ERF	8:00	8:00	8:00	8:00
Total Response Time	Total Response Time 1st Due	7:30	6:30	7:30	7:30
	Total Response Time ERF	10:00	8:00	15:00	15:00

Performance Objectives – Baselines

Fire Suppression Services Program

For 90 percent of all structure fires, the total response time for the arrival of the first-due unit, staffed with 2 firefighters and 1 officer, shall be: 8 minutes and 30 seconds in all areas. The first-due unit for all risk levels shall be capable of: providing 500 gallons of water and 1,500 gallons per minute (gpm) pumping capacity; initiating command; requesting additional resources; establishing a back-up line and advancing an attack line, each flowing a minimum of 150 gpm; establishing an uninterrupted water supply; containing the fire; rescuing at-risk victims; and performing salvage operations. These operations shall be done in accordance with departmental standard operating procedures while providing for the safety of responders and the public.

For 90 percent of all moderate structure fires, the total response time for the arrival of the effective response force (ERF), staffed with 13 firefighters and officers, shall be: 12 minutes in all areas. The ERF shall be capable of: establishing command; appointing a site safety officer; providing an uninterrupted water supply; advancing an attack line and a backup line for fire control; complying with the Occupational Safety and Health Administration (OSHA) requirements of two- in and two-out; completing forcible entry; searching and rescuing at-risk victims; ventilating the structure; controlling utilities; and performing salvage and overhaul. These operations shall be done in accordance with departmental standard operating procedures while providing for the safety of responders and the public.

Emergency Medical Services Program

For 90 percent of all EMS responses, the total response time for the arrival of the first-due unit, staffed with a minimum of 2, shall be: 7 minutes and 30 seconds in all areas. The first-due unit shall be capable of: assessing scene safety and establishing command; sizing-up the situation; conducting an initial patient assessment; obtaining vitals and patient's medical history; initiating mitigation efforts within one minute of arrival; providing first responder medical aid including automatic external defibrillation (AED); and assisting transport personnel with packaging the patient.

The department relies upon Butte County Ambulance, a third-party provider, to complete the effective response force (ERF) component of its EMS program. The initial arriving fire department company shall have the capabilities of providing first responder medical aid including AED, until the third-party provider arrives on scene. If the third-party provider unit arrives on scene first, its personnel shall initiate care and the staff from the initial fire department company shall provide support as needed.

Hazardous Materials Services Program

For 90 percent of all hazardous materials response incidents, the total response time for the arrival of the first-due unit, staffed with 2 firefighters and 1 officer, shall be: 8 minutes and 30 seconds in all areas. The first-due unit shall be capable of: establishing command; sizing up and assessing the situation to determine the presence of a potential hazardous material or explosive device; determining the need for additional resources; estimating the potential harm without intervention; and begin establishing a hot, warm, and cold zone.

For 90 percent of all moderate hazardous materials response incidents, the total response time for the arrival of the effective response force (ERF) including the hazardous materials response team, staffed with 12 firefighters and officers, shall be: 20 minutes in all areas. The ERF shall be capable of: appointing a site safety officer; and providing the equipment, technical expertise, knowledge, skills, and abilities to mitigate a hazardous materials incident in accordance with department standard operating guidelines.

Rescue Services Program

For 90 percent of all technical rescue incidents, the total response time for the arrival of the first-due unit, staffed with 2 firefighters and 1 officer, shall be: 8 minutes and 30 seconds in all areas. The first-due unit shall be capable of: establishing command; sizing up to determine if a technical rescue response is required; requesting additional resources; and providing basic life support to any victim without endangering response personnel.

For 90 percent of all technical rescue incidents, the total response time for the arrival of the effective response force (ERF), staffed with 10 firefighters and officers including the technical response team, shall be: 20 minutes all areas. The ERF shall be capable of: appointing a site safety officer; establishing patient contact; staging and apparatus set up; providing technical expertise, knowledge, skills, and abilities during technical rescue incidents; and providing first responder medical support.

Summaries of the Department's benchmarks objectives are presented below.

Table 83: Summary of Chico Fire Department's Baseline Objectives

Measured at the 90th Percentile		Suppression	BLS	HazMat	Tech Rescue
Call Processing	Pick-up to Dispatch	1:30	1:30	1:30	1:30
Turnout	Turnout Time 1st Unit	1:30	1:30	1:30	1:30
	Turnout Time for ERF	1:30	1:30	1:30	1:30
Travel	Travel Time 1st Due	6:00	6:00	6:00	6:00
	Travel Time ERF	10:30	9:00	10:30	10:30
Total Response Time	Total Response Time 1st Due	8:30	8:30	8:30	8:30
	Total Response Time ERF	13:00	12:00	20:00	20:00

COMPLIANCE METHODOLOGY

This Standards of Response Coverage document is designed to guide the Department to continuously monitor performance, seek areas for improvement, and to clearly articulate service levels and performance to the community we have the privilege of serving. Therefore, the Fire Chief has established a Compliance Team to continuously monitor elements of this SOC and make recommendations for system adjustments or improvement quarterly.

Compliance Team / Responsibility

The Compliance Team will consist of the following department members (TBD) and will have the responsibility of continuously monitoring changes in risk, community service demands, and department performance in each program area, fire department demand zone, and/or risk category.

- Chair – Division Chief
- Member – SOC Representative
- Member – Community Risk Reduction Representative
  Member – EMS Representative

Performance Evaluation and Compliance Strategy

The Chico Fire Department will evaluate system performance by measuring first due unit performance at the 90th percentile quarterly and annually. In addition, the Department will evaluate first due performance by each individual fire station demand zone and by program area. Measures for the effective response force by each program area, fire station demand zone, and risk category will be evaluated annually. Annual reviews will be conducted in January of each year regarding the previous year. All response performance monitoring will exclusively evaluate emergency responses.

The compliance team will determine the strengths, weaknesses, opportunities, and threats of the system performance annually and make recommendations for system adjustments to the Fire Chief. Finally, the Department will annually update and evaluate the risk assessment matrices for relevancy and changes in community risk.

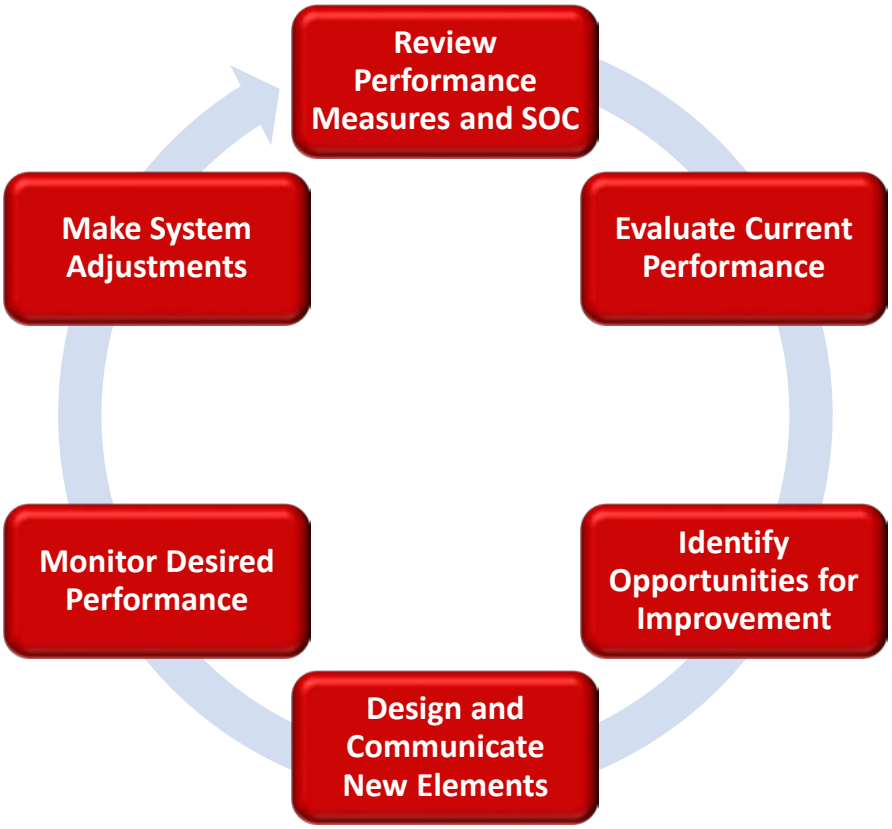
Compliance Verification Reporting

The compliance team will communicate results of the period evaluations to the Fire Chief. The Fire Chief will disseminate the quarterly and annual results and any system adjustments in a timely manner so that both performance measurement and continuous improvement becomes part of the organization's culture. All performance and risk measures will be reported to the City Manager and/or City Council and available to the community annually.

Constant Improvement Strategy

The Department utilizes the following conceptual model to facilitate both compliance and continuous improvement.

Figure 69: Continuous Improvement and Compliance Model



OVERALL EVALUATION, CONCLUSIONS, AND RECOMMENDATIONS

Overall Evaluation

The overall evaluation is the final component of the Standards of Cover (SOC) process. As a risk-based process that incorporates risk, mitigation, and outcomes measures, both the Department and the City's leadership can more easily discuss service levels, outcomes, and the associated cost allocations based on community risk.

Overall, the department is well performing within the current system. The community enjoys high quality services from a professional and well-trained department. Predominantly, the department's distribution and concentration delivery models are appropriately aligned with the Department's unique risks. However, there are areas that have been identified that the Department could make incremental system adjustments to improve.

General Observations

Total Response Time

The Department has not established goals for system performance prior to the completion of this SOC. In most instances, the Department does not meet nationally recommended goals for call processing and turnout times. The aggregate performance is more representative of the system performance. The individual station demand zones performance provides understanding of the compartmentalized performance. This SOC is intended to establish baseline and benchmark (goals) performance objectives for the Chico Fire Department.

Observations and remedies:

- The community and department would benefit from established performance goals.
- Prior to the completion of this SOC the department did not utilize a separate baseline performance and a desired goal system.
- The department could impact the total response time in most instances with the improvement of call processing and crew turnout time.
- Call processing and turnout time performance is typically within personnel and management control.
- The Department and City would benefit from a full communications center review in an effort to identify gaps from best practices and opportunities for improvement.
- The Department currently is performing (2015) at a 6-minute travel time for all fire-related incidents.
- It is recommended that the City and Department codify a 6-minute travel time as the systems baseline objective while maintaining the ability to continuously improve as desired.

As previously discussed, the overall department performance for EMS incidents is at 5.1 minutes at the 90th percentile and accounts for the majority of requests for service (64%). However, Squad 1 provided approximately 16% of the EMS incidents at 4.5 minutes at the 90th percentile. The overall EMS performance may be unduly influenced by the current deployment strategies since the same fire suppression apparatus are utilized for both fire and EMS incidents. Therefore, the fire suppression program performance of 6.0 minutes would better represent the actual performance capabilities of both the current distribution model and historical performance. This assumption is validated by the GIS analyses as the program would indicate that the department could perform at 89% at 6-minutes. In other words, there is 99% agreement between the historical performance and the GIS analyses.

Data

The department has a myriad of data resources, however, some of the data elements are not aligned well with "new" data requirements of a risk-based process included in this SOC.

Observations and remedies:

- Internal prevention data-base does not include sufficient elements for a robust risk analysis.
- Prevention data-base could be updated and designed to capture the elements desired by the Department for continuous monitoring and to update the SOC annually and within five (5) years.
- Data alignment should support key strategic community risk reduction programs that reflect the current organizational chart and strategic objectives.
- Chico Emergency 9-1-1 Communications does not prioritize EMS calls using a recognized Medical Priority Dispatch System (MPDS) that is approved and evaluated by a Medical Director and used in alignment with Butte County EMS. This would allow the department to measure the acuity, severity, of calls for service. Low acuity calls for service may not need the response of a first responder, or an ambulance.
- The Department may benefit from an updated RMS system for fire reporting that is integrated with the CAD. For example, the RMS system should be auto-populated from the CAD for elements of time, addresses, allocated resources, etc.

Internal Performance Goals and Planning Validation

The department's actual total response time performance is 7:12 and 8:24 for EMS and fire related incidents, respectively. Understanding that predominantly the same apparatus types (Engines and Trucks) are utilized for the delivery of both EMS and Fire related incidents, the Fire program area's travel time performance (6-mintues) was utilized as the upper threshold for planning purposes. Data is reproduced below.

Table 84: 90th Percentile Turnout and Travel Time of First Arriving Units by Call Category

Program	Dispatch Time	Turnout Time	Travel Time	Turnout and Travel	Response Time	Sample Size
EMS	1.3	1.9	5.1	6.4	7.2	6,592
Fire	1.7	2.2	6.0	7.4	8.4	1,171
Rescue	1.5	1.5	8.4	9.9	11.1	5
Hazmat	2.8	2.0	5.4	7.1	7.8	74
Total	**1.4**	**2.0**	**5.3**	**6.6**	**7.3**	**7,842**

In addition to the quantitative analyses provided, Geographic Information System (GIS) analyzed the station locations and associated travel time capabilities. The current capabilities were evaluated to determine if, from a planning perspective, a 6-minute travel time is obtainable within the current configuration. The historical performance demonstrated a 6.0 travel time capability from the existing fire stations (excluding Station 3) at the 90th percentile and the planning assessment estimated 89.12%. Therefore, there is more than 99% agreement between the planning tools and the actual historical performance.

Results suggest that if the Department is desirous of maintaining current performance that it will require a five fire station configuration in order to most closely approximate a 6-minute travel time to 90% of the incidents. Station 2 was able to contribute 58.25% of the geographic coverage and the combination of Station 1 and 2 can cover nearly 80% of the historical incidents.

When referring to the table below, the table can be interpreted as follows: The number one ranked station is Station 2 and would be able to respond to 58.25% of the Department's incidents within 6 minutes. Each station provides additional coverage, but with a diminishing return, until Station 5 brings the total system capability to 89.12%. Data is presented below.

Table 85: 6-Minute Travel Time Capabilities

Rank	Station Number	Station Capture	Total Capture	Percent Capture
1	2	7033	7033	58.25%
2	1	2538	9571	79.28%
3	5	698	10269	85.06%
4	4	353	10622	87.98%
5	6	138	10760	89.12%

Implications of Potential Changes in Butte County Deployment

The current configuration of automatic aid between the City of Chico and Butte County has Station 42 providing considerable first due responses within the City. While this is considered best practice when the unit is the closest resource to the incident and has commensurate capabilities, the City should understand the implications associated with changes to the County's distribution model.

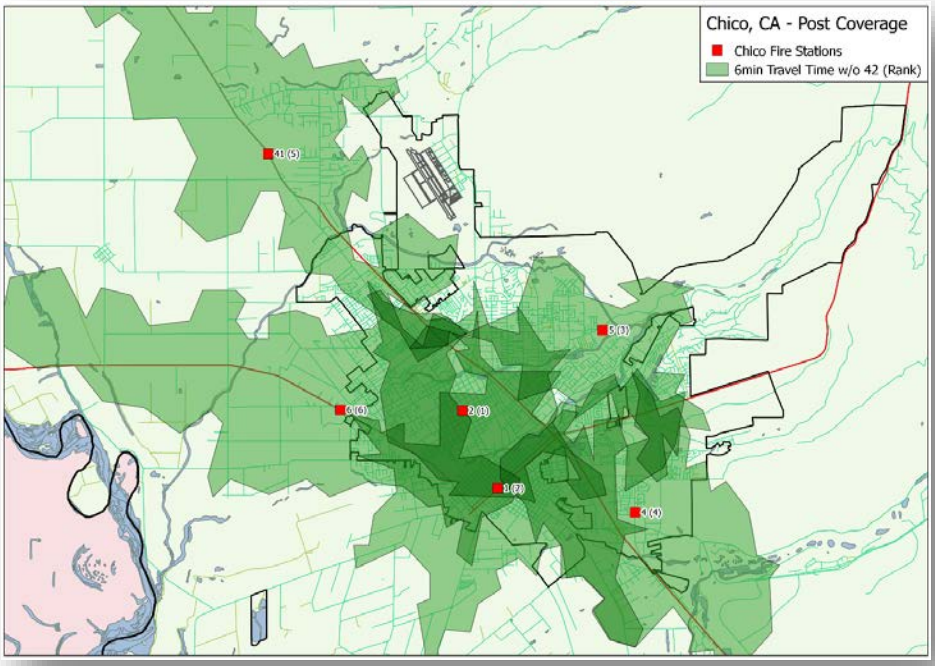
Previous analyses have suggested that Stations 41 and 44 would contribute less than 1% to Chico's overall performance and capabilities and therefore will not be analyzed again here. However, both geographically and strategically, Station 42 supplements the City's performance. An analysis of the implication of Station 42 closing on the system's ability to maintain a 6-minute or less travel time performance was completed.

Results suggest that it would require a six-station distribution model to maintain the 6-minutes or less 90% of the time. However, when evaluating the relative performance adjustments, a four-station model will accomplish the desired performance approximately 88% of the time, or 2% below the current configuration. Therefore, the better system design would include either Station 42 or a Chico fire station near Station 42's location. From a policy perspective, a similar four-station configuration without Station 42 may not be deemed unreasonable when compared to the costs associated with a 2% improvement.

Table 86: Marginal Fire Station Contribution with Chico and County Fire Stations for 6-Minute Travel Time (excluding Station 42)

Rank	Station Number	Station Capture	Total Capture	Percent Capture
1	2	7033	7033	58.25%
2	1	2538	9571	79.28%
3	5	698	10269	85.06%
4	4	353	10622	87.98%
5	41	182	10804	89.49%
6	6	138	10942	90.63%
7	44	32	10974	90.90%

Figure 70: 6-Minute Travel Time Bleed with Chico and County Fire Stations (excluding Station 42)



Potential Station Considerations

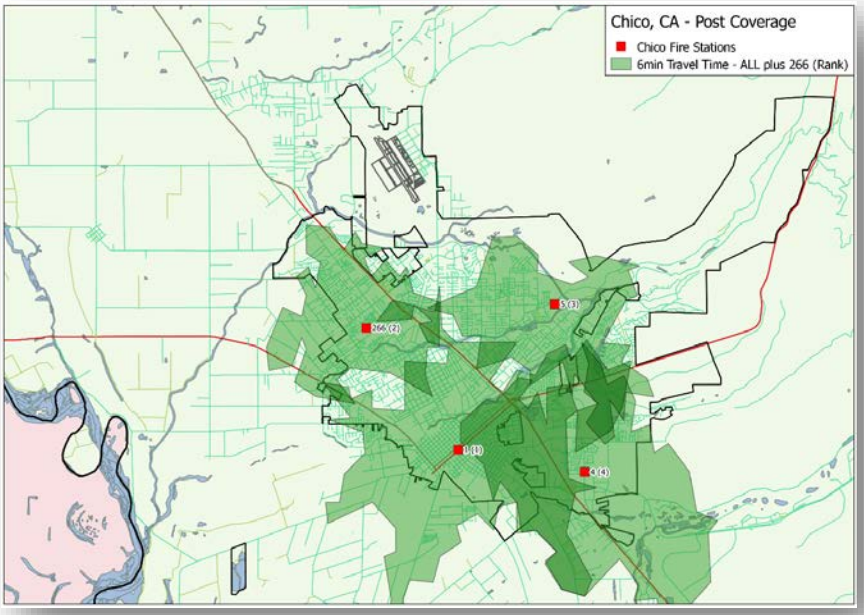
The Chico Fire Department presented *FITCH* with two distinct station consolidation efforts to evaluate the potential impact of adopting these changes. Most notably, these changes are associated with the combining of Station's 2 and 6, identified for these analyses as the new Station 266. Similarly, the concept of creating a potential Public Safety Facility (Police and Fire), identified for these analyses as new Station 444 was evaluated. The desired locations of these potential station consolidations were provided by the Department and were incorporated into the analyses as if the stations currently existed as well as simultaneously removed Stations 2, 4, and 6.

First, the impact of creating Station 266 was evaluated. Results suggest that the remaining four-stations provided by Chico will accomplish a 6-minute travel time at 88.5%, or 1.5% less than optimal design. Similar to the previous discussion with Station 42, it would not be unrealistic for a policy group to be willing to assume the 1.5% of potential risk within the context of the additional cost to achieve the 90th percentile.

Table 87: Marginal Fire Station Contribution for Station 266 with Chico Fire Stations for 6-Minute Travel Time

Rank	Station Number	Station Capture	Total Capture	Percent Capture
1	1	6804	6804	56.36%
2	266	2512	9316	77.16%
3	5	1022	10338	85.63%
4	4	353	10691	88.55%

Figure 71: 6-Minute Travel Time Bleed with Chico Fire Stations and Creating Station 266

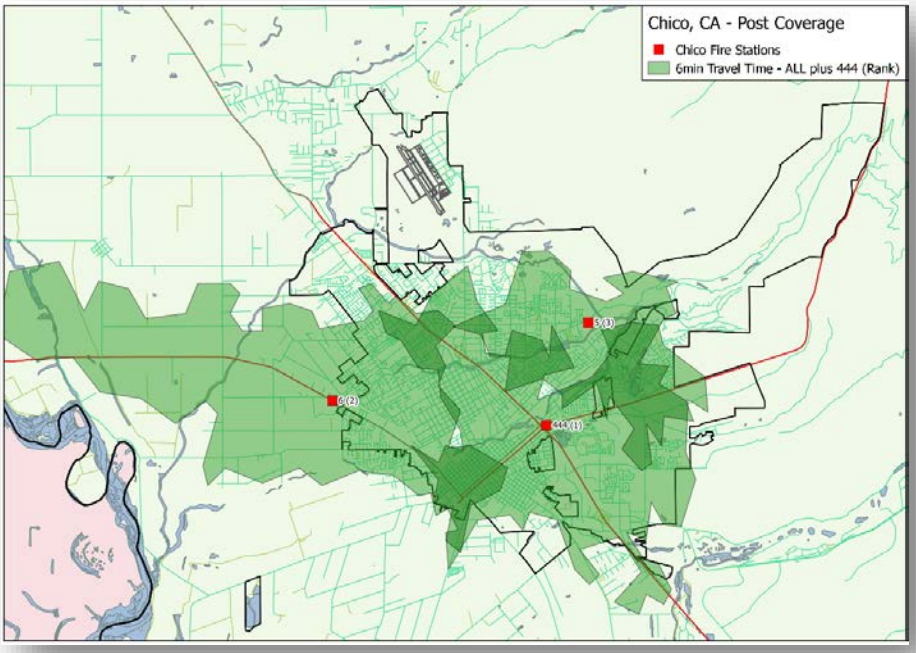


Second, the impact of creating Station 444 was evaluated. Results suggest that the creation of Station 444 would become the highest performing station in the system capturing nearly 71% of the historical incident risk within 6-minutes travel time. This configuration would afford a three-station distribution model that would achieve a six-minute travel time 92.07 of the time. This reconfiguration would only require Stations 444, 6, and 5 to achieve this level of performance. Stations 1 and 2, that historically contributed the most to the overall system performance, would only improve the system by approximately 1.5%.

Table 88: Marginal Fire Station Contribution for Station 266 with Chico Fire Stations for 6-Minute Travel Time

Rank	Station Number	Station Capture	Total Capture	Percent Capture
1	444	8531	8531	70.66%
2	6	2038	10569	87.54%
3	5	547	11116	92.07%
4	2	162	11278	93.42%
5	1	20	11298	93.58%

Figure 72: 6-Minute Travel Time Bleed with Chico Fire Stations and Creating Station 444



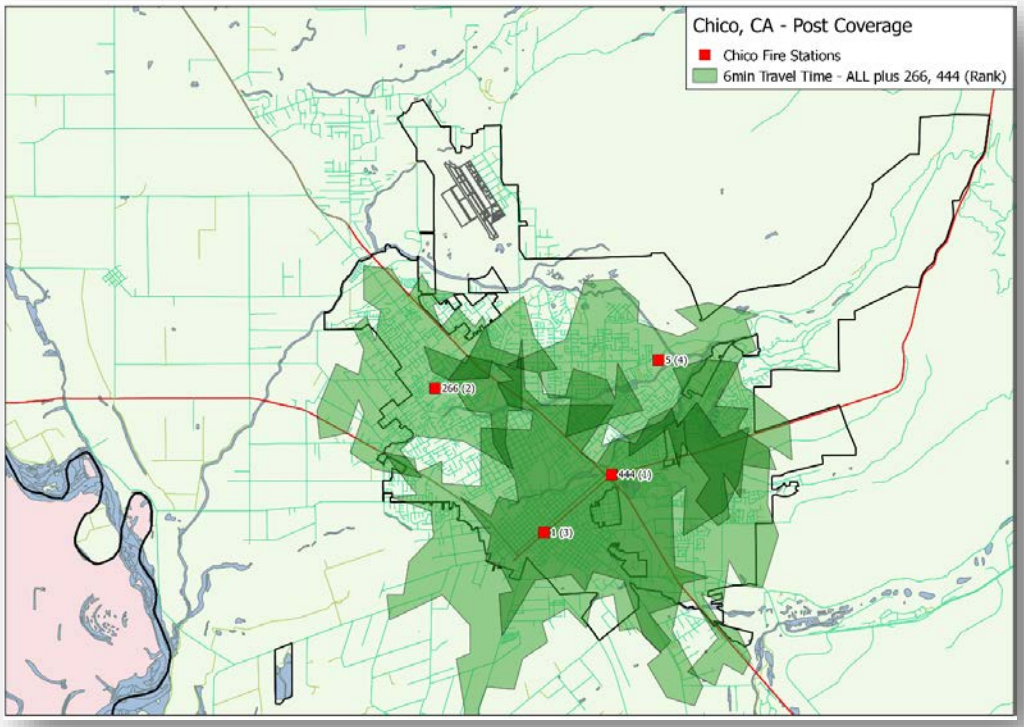
While the three-station model provides for the geographic coverage in the distribution model, it reduces the concentration of resources for both the historical call locations and the measured risk.

Finally, the creation of both Stations 266 and 444 were analyzed. Results demonstrate that a four-station distribution model would be required to address the historical demand for services and the geographic limitations within the system. Like previous discussions, the potential for a three-station model does exist at 88.88%, or nearly 89% coverage at 6-minutes travel time. However, this four-station configuration would outperform the current five-station configuration by approximately 4%. Results are presented in both tabular form and map output below.

Table 89: Marginal Fire Station Contribution for Stations 266 and 444 with Chico Fire Stations for 6-Minute Travel Time

Rank	Station Number	Station Capture	Total Capture	Percent Capture
1	444	8531	8531	70.66%
2	266	1323	9854	81.62%
3	1	876	10730	88.88%
4	5	547	11277	93.41%

Figure 73: 6-Minute Travel Time Bleed with Chico Fire Stations and Creating Stations 266 and 444



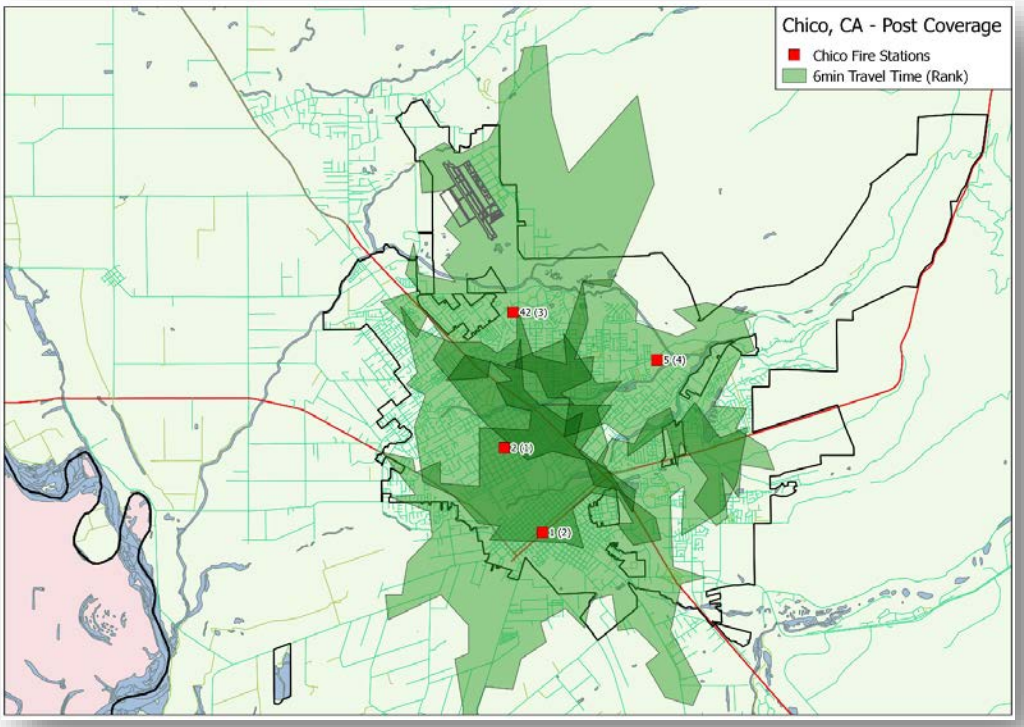
Long-term System Reconfiguration – Alternative 1

It is understood that the Butte County Fire Department (Cal Fire) provides automatic and mutual aid coverage for the City of Chico and are within relatively close proximity to the City limits. Therefore, several additional analyses were completed to determine the efficacy of the combined system to deliver a six-minute travel time or less to 90% of the incidents with the variable assumptions levied. Results found that the county's three fire stations (41, 42, and 44) contributed an additional 8.8% but the synergy between combined station locations affords a four-station distribution model to maintain the current six-minute travel time performance as well as improves overall performance by approximately 3%. Station 42 is best positioned to provide improvement and accounted for 8.32% of the 8.8% improvement. Results are provided below.

Table 90: Marginal Fire Station Contribution with Chico and County Fire Stations for 6-Minute Travel Time

Rank	Station Number	Station Capture	Total Capture	Percent Capture
1	2	7033	7033	58.25%
2	1	2538	9571	79.28%
3	42	1005	10576	87.60%
4	5	639	11215	92.89%
5	4	353	11568	95.82%
6	6	137	11705	96.95%
7	41	85	11790	97.66%
8	44	32	11822	97.92%

Figure 74: 6-Minute Travel Time Bleed with Chico and County Fire Stations (excluding Station 3)



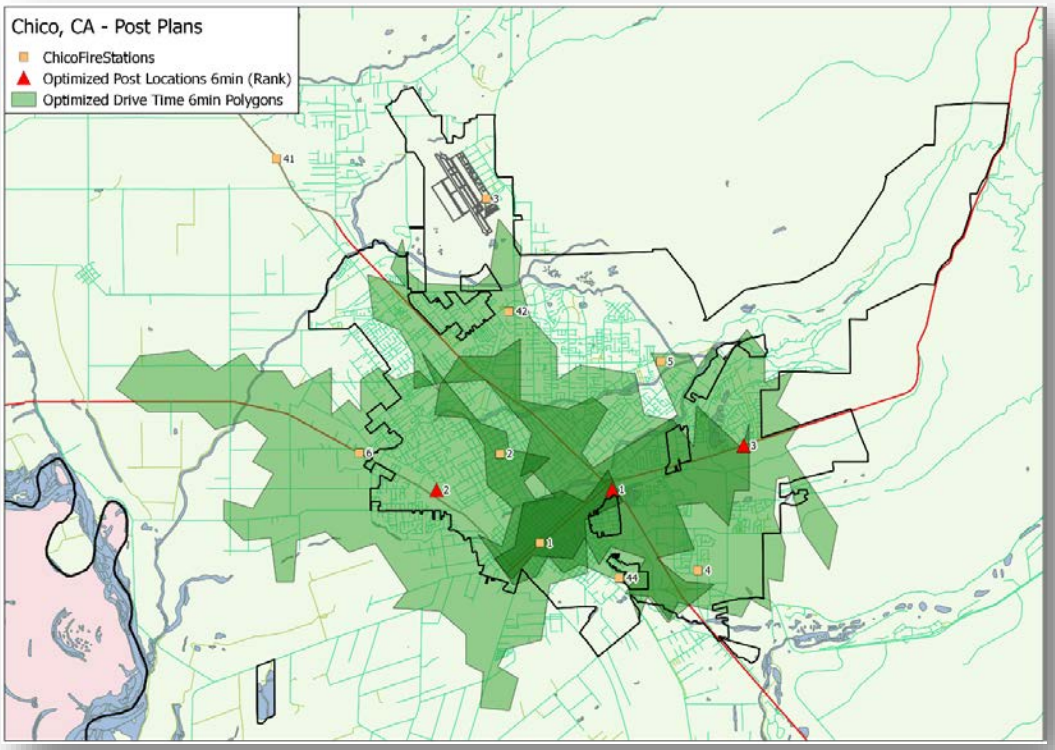
Considering all of the different configurations evaluated, and specifically a balance between the coverage of prospective occupancy risk and the community's historical demand, the four-station model that includes Stations' 1, 2, 42, and 5 would provide the greatest coverage. This model would provide for a greater concentration of resources nearest to the City's greatest risk near downtown and maintain the geographic coverage required with the least capital investment. Therefore, this alternative is the recommended system configuration.

Optimized Station Distribution Plan

Finally, an analysis was completed to develop an optimized station distribution model. This evaluation confirmed previous analyses that an optimized three-station model can provide for greater than 90% effectiveness covering all incidents within 6-minutes or less travel time 92.04% of the time. Both the suggested station locations and the current City and County stations are located on the map for reference. It is interesting to note that the number one optimized station is nearly identically placed with the department's consolidated Station 444. A graphic illustration is presented below.

This is provided for future consideration when building, rebuilding, or relocating fire stations.

Figure 75: Optimized Station Deployment Plan - 6-Minute Travel Time



Risk-based Approach to the Allocation of Resources

Following a risk-based approach to managing risk in the Department, two FDZ's qualified as high -risk demand zones in Station's 1 and 2 respectively. Station 1 has one unit continuous staffed (Ladder) and a strategically staffed Squad unit.

However, the Department's allocation of resources is not commensurate at this time with respect to Station 2. While utilizing a systematic approach to risk, it is recommended that the Department consider reallocating apparatus and personnel to Stations with higher risk. This will assist the Department in multiple manners. First, the higher risk area should have a higher concentration of personnel and apparatus, maintaining a commensurate approach to managing and mitigating risk. Second, the risk matrices created with this SOC can serve as planning tool as the community's risk profile evolves. In other words, there is a set of thresholds that will guide the City and Department in understanding where resources are required and why.

As previously, discussed, the figure below is how the Department is currently staffed and deployed.

Table 91: Current Station Deployment and Risk Concentration Summary

Station FDZ	Engine	Ladder	Rescue	Squad	Total Risk Score	Station Risk Concentration Identification
1		1		1[a]	8.25	High
2	1		1[b]		9.22	High
3	1[c]				2.65	Low
4	1				4.90	Moderate
5	1				4.58	Moderate
6	1				4.24	Moderate

Note: a=strategically staffed unit; b=cross staffed unit; c=Single person unit for airport

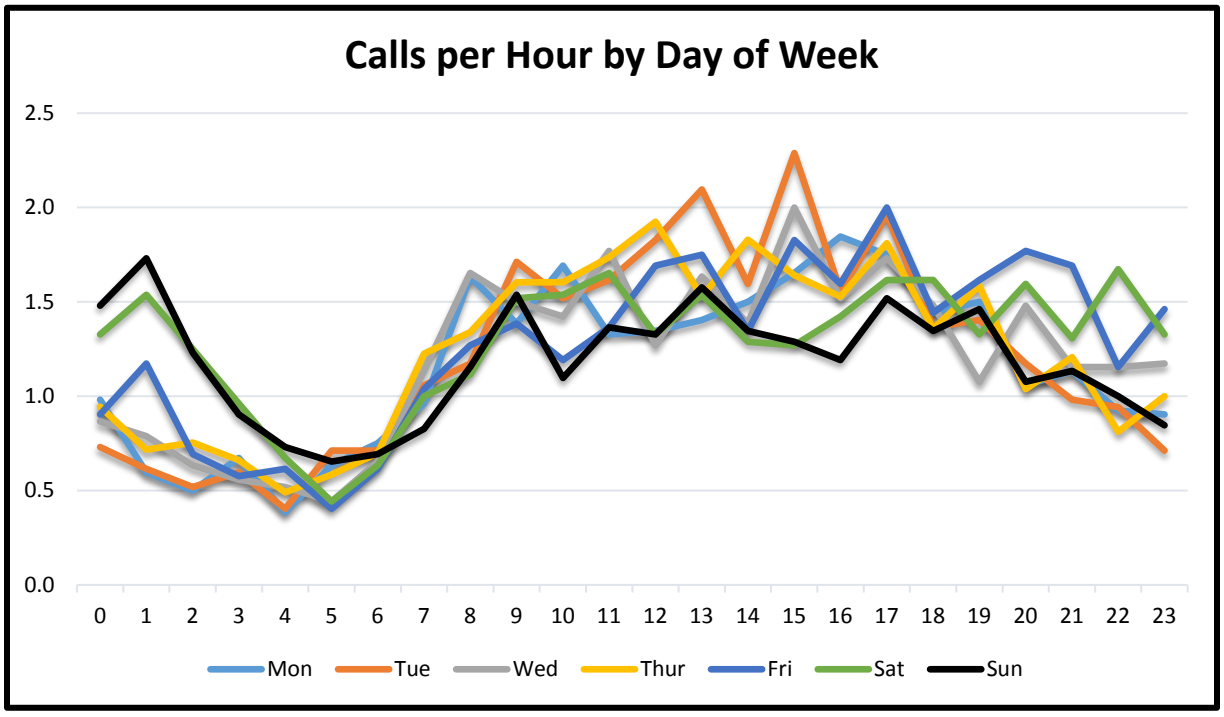
The posited Alternative 1 would include the following system changes: First, the capital footprint would be reduced from six (6) fire stations to four (4) stations by closing (or not staffing) Stations 3, 4, and 6. In addition, a new station would need to be constructed in the vicinity of the existing Station 42 provided by the County. Second, while maintaining current performance for fire related incidents, resources could be re-allocated to the remaining four (4) stations to increase the concentration of personnel to handle both the higher demands for service and the potential occupancy risk in those areas. Specifically, it is suggested that Squad 1 is moved from Station 1 as a strategically staffed unit and is permanently assigned to Station 2 as a continuously staffed two-person unit. Simultaneously, one of the engines from Stations' 3, 4, or 6 could be relocated to Station 1 to maintain both an Engine and a Ladder, each continuously staffed with three personnel. It is suggested that the Engine provide the most frequent incident runs to avoid costs associated with running a large ladder apparatus to medical calls.

The construction of the new Station near existing Station 42 would only be a capital project as the recurring costs for personnel; apparatus and other operating costs would remain constant from the Engine and personnel relocated from either Stations' 4 or 6.

This alternative would maintain the current fire performance, reduce capital liabilities through efficiencies, and provide for a greater concentration of resources in the areas with the most risk and demand. The overall number of shift personnel remains consistent with current practices and maintains the capabilities of assembling an effective response force with the understanding that there is limited regional support.

Finally, the geographic limitations are overcome with the four (station) model, but the numbers of resources required for resource demand require the additional units to remain. Adopting a four (4) station base distribution model, it would still require two additional units to cover the average demand for services and the occupancy risk for a total of 6 resources. For example, the figure below illustrates that two additional units would accommodate the average demand with few exceptions.

Figure 76: Average Calls per Hour by Day of Week



If the City and Department consider Alternative 1, the suggested deployment strategy is summarized and provided below.

Table 92: Recommended Station Deployment and Risk Concentration Summary

Station FDZ	Engine	Ladder	Rescue	Squad	Total Personnel by Station
1	1	1			6
2	1		1[a]	1	5
42	1				3
5	1				3
Total Units/Personnel	4 Engines	1 Ladder	1 Rescue [a]	1 Squad	17[b]

Note: a=Cross-staffed unit; b=Add 1 more FTE for Division Chief for a Total of 18.

Long-term System Reconfiguration – Alternative 2

An evaluation of the Department's provision of EMS services surfaced a second alternative deployment strategy. Approximately 64% of the Departments response history is associated with the provision of Basic Life Support (BLS) services. The County ambulance service provides Advanced Life Support (ALS) services for the City. For the most part, the Department is relegated to respond to EMS incidents with larger fire apparatus that can be less efficient than smaller apparatus such as quick response vehicles or ambulances.

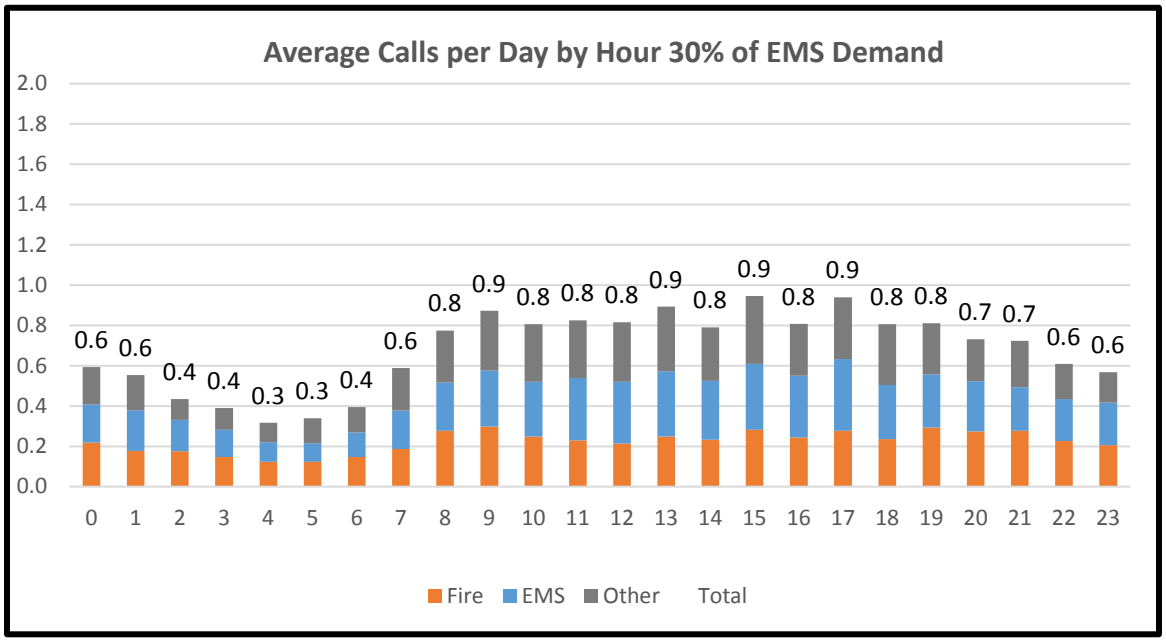
Further inspection of the time on task revealed that while the Department is responding in a timely manner, the average call duration for EMS incidents is approximately 14 minutes. Understanding that the average turnout and travel time is approximately 4 minutes and 24 seconds, the actual time on scene completing patient care is less than 10 minutes before either available or turned over to the ambulance transport provider.

Therefore, Alternative 2 provides for consideration of discontinuing EMS response to all lower-acuity medical incidents that are less time-sensitive and focusing the Department's efforts on responding to higher-acuity or life threatening emergencies where time has a greater impact on the clinical outcome as well as the need for additional personnel such as with a cardiac arrest, penetrating chest wound, or major trauma injury.

The adoption of this alternative would create considerable capacity to cost avoid additional resources in the future as the fastest growing call type is for EMS incidents as well as provide for a more efficient and effective response to seriously sick and injured patients. Another benefit is the introduction of additional capacity into the system to maintain a high degree of readiness and available concentration of resources for fire prevention, community risk reduction, and fire suppression activities. The greatest return on investment is associated with risk reduction and prevention activities. For example, the field crews could now participate in fire inspections and other non-emergent activities that serve to reduce community risks.

Understanding that typically, only 30% or less of the EMS incidents would fall into the higher-acuity or resource intensive call types, the Department could reintroduce 70% of the EMS capacity back into the system. This would allow for long-term sustainability of the suggested deployment strategy and enhanced risk reduction activities as previously discussed. A normalized demand curve is presented that is restricted to 30% of the current EMS demand for services below.

Figure 77: Annualized Demand Curve



If the City is to consider either Alternative 2 or a combination of both Alternatives 1 and 2, a call prioritization system would have to be purchased and implemented in order to confidentially triage requests for EMS service. Medical priority dispatching is an internationally accepted best practice.

Finally, while this alternative would only require a minimum of five units to meet the demands for service, this would not diminish the recommendation to maintain the effective response force of 17 personnel on-duty.

Impact of Loss of SAFER Funding

Unfortunately, the City and Department were not able to receive the SAFER grant for 2017. The available funding from the previous grant afforded maintaining the 2016 status quo funding through January of 2017. When reviewing the policy timeline for both pre and post SAFER, three clear pathways emerge for consideration.

First, the SAFER grant is intended to assist in increasing or maintaining staffing levels with a general intent to assist agencies in moving closer to meeting NFPA 1710 guidelines. Within the guidelines of the SAFER grant, agencies must continue to maintain the staffing prior to the acceptance of the grant. In other words, the grant prohibits agencies from reducing staffing by a commensurate level during the grant period. This is done to prevent agencies from reducing local fiscal burden without the benefit of the additional staffing. However, it is acceptable for the agency to utilize the SAFER grant to maintain staffing that otherwise would have been lost through budget realities, a common occurrence during the recession. Therefore, with this understanding one option is to encumber the funds and maintain the 2016 status quo of 66 FTEs.

Second, the department's staffing and budget prior to the acceptance of the SAFER grant provided for 51 FTE's (17 a shift) and approximately $900,000 in overtime. Currently, with the SAFER grant, the Department is allocated 66 FTE's roughly separated by 50/51 shift FTEs funded by the City and the balance funding by SAFER for 15/16 FTEs. In addition, approximately $300,000 is allocated for overtime.

Utilizing the average leave history of the occupied positions in 2015, the optimal staffing relief multiplier is 3.52 not included the DC position. In other words, each "seat" on a shift apparatus will require three positions, one for each of the shifts, and an additional 0.52 employees to cover leave. Leave history includes all vacation, holiday, sick, worker's compensation, and miscellaneous and otherwise categorized leave. Utilizing this optimized staffing formula, it is suggested that the required staffing to accomplish Alternative 1 would require a total of 60 FTEs to maintain a minimum daily staffing of 17 positions. Therefore, some capacity currently exists to reduce by 6 FTEs and maintain the desired minimum staffing.

Finally, understanding that the City and Department did not allocate funds to offset the potential lost revenue from the SAFER grant, and if no other viable funding source is available or desirable, the expenditures cost equivalency of the SAFER grant may have to be realized through other means such as staff reductions. The way the current budget approach has allocated funds, it would appear that the City could reduce by 15/16 positions and continue to maintain a minimum of 17 personnel on shift (51 / 3 =17).

However, the staffing analysis reveals that 50/51 positions is not sufficient to maintain 17 personnel on shift without considerable overtime liability; a likely contributor to the $900,000 overtime budget experienced under this previous strategy. Some communities utilize overtime to offset a constant staffing model where all vacancies are covered with overtime assignments. Other communities elect to provide for sufficient relief personnel to cover planned or expected vacancies based on past experience. Utilizing a relief-staffing model serves to limit overtime liabilities but increase personnel costs. Utilizing the relief staffing multiplier of 3.52, 50 FTEs would afford for approximately 14 continuously staffed positions. This is short of the recommended 17 per shift. It is our recommendation that the City and Department would be better served with the additional personnel rather than a larger overtime liability. It provides for greater capacity for larger emergencies, deployments, and unusual leave history.

Therefore, if the second SAFER alternative is desirable, the City would reduce the overall FTEs from the SAFER level of 66 to 60, requiring an increase in funding for 10 FTEs. This would afford the city to fully implement "Alternative 1" and reduce capital liabilities, maintain current performance of 6-minute travel time, and constantly staff the Squad truck.

With that said, a pure reduction of 15 personnel, would provide the department with approximately 14 personnel on shift each day and a significant increase to the overtime budget. This would require the reduction of one of the following combinations:

- Taking the 2-person squad out of service and the Captain from Station 3
- Taking the 2-person squad out of service and the 4th person off of the ladder truck company
- Taking a 3-person engine company out of service.

The system design recommended in Alternative 1 will require all of the design elements to be present. If the City and Department elect to operate with five apparatus rather than six, and do not reduce the demand for services proportionately, then the response time will be longer than designed. However, analyses suggest that 99% of the incidents could be handled within an 8-minute travel time, or up to two minutes longer as the system becomes stressed.

However, it is recommended that a minimum shift staffing of 17 line personnel each day is the appropriate shift strength for the department. Understanding that if the city has to make a difficult policy decision, the City and Department should work with the City Council to establish a timeframe to complete this recommendation.

The recommended staffing levels are an efficient and effective deployment strategy for the department given the prospective risk and the historical demand for services. In addition, the Department does not have significant and timely automatic aid capacity as similarly situated municipalities may enjoy in a metropolitan area. The fact that considerable risk is present within the city, and particularly unprotected risk in the downtown corridor, the City has to carry the full burden of providing an effective firefighting force.

Medical Priority Dispatching System (MPDS)

An integral component to considering Alternative 2 is to have the system confidence that a reliable and well-designed medical priority call triage system is utilized to correctly and accurately prioritize emergency medical service calls at the dispatch center. As previously discussed, the City is encouraged to move forward with the procurement and implementation of a priority dispatch/triage system.

Ensuring Quality and Accountable EMS Services

If the City and Department considered Alternative 2, it is suggested that the City continue to work with the LEMSA to ensure that the City can participate in the development of performance standards for the ambulance transport provider. Through this lens, the City maintains the responsibility to ensure quality services are provided to the community and that the desired performance is being met, even though they may no longer serve as the primary provider for lower acuity incidents.

Organizational Structure and Staffing Optimization

Within the context of shift-based staffing, an optimization analysis was completed utilizing the historical average leave over the most recent year and proportioned by the number of filled positions, not the allocated number of FTEs. The analysis suggests that the most efficient utilization and allocation of human resources to maintain a 56-hour workweek and provide for a minimum of 17 personnel on each shift would require a total of 60 personnel. The department currently has 66 positions allocated, or two additional per shift. The City and Department has managed their FTE count well as the additional three positions may be a policy position in an attempt to cover other non-response driven initiatives, reduce potential overtime, etc.

However, the Department may be well served to consider utilizing the existing capacity to create some administrative assistance. The organizational structure utilizes a fire chief and one division chief for daily continuity and administrative capacity. All other uniformed personnel are shift-based with varying schedules. In addition, the Division Chiefs' serve multiple functions and divide time between shift management and the entire division functions such as Prevention, Training, and Operations. Onsite interviews and observations reveal that this practice may not be the most effective and may serve to limit the capacity in fire prevention and community risk reduction that has the greatest return on investment for reducing risk and resources required for mitigation.

A department of this size and complexity may be well served to add additional administrative capacity by utilizing the available FTE's identified. A more traditional organizational structure would include an additional Deputy Chief that can assist in formalizing organizational functions and priorities. The remaining two FTEs could be utilized to hire an additional fire inspector (if Alternative 2 is not implemented) and the future of the fire service will require specialized IT assistance at the Department level to manage data-related performance measures and support existing systems such as CAD, MDTs, AVL, and GIS activities.

Long-Term Sustainability of the Models Presented

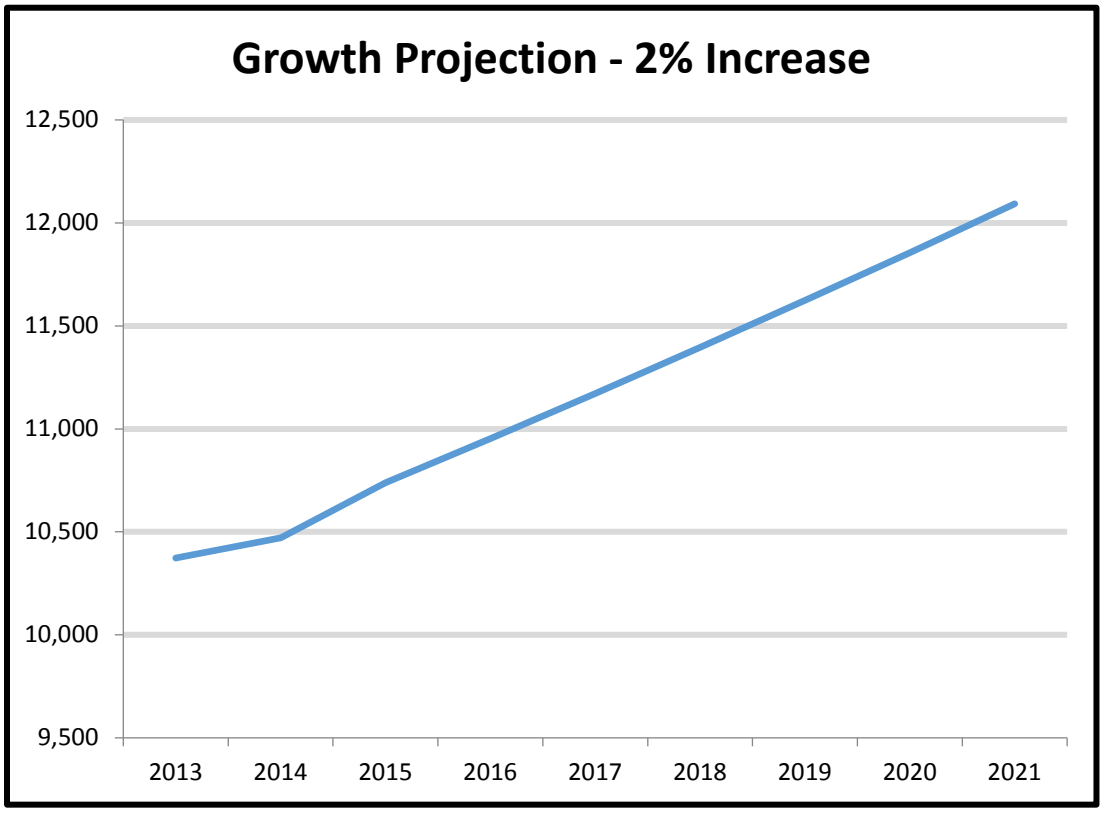
With respect to the long-term sustainability of the deployment models presented here, the models will remain accurate for as long as the jurisdictions overall coverage area has not expanded. In other words, if the City remains 33 square miles, then the deployment strategy will be sustainable indefinitely with respect to the coverage area. As other variables such as population density or changes in socioeconomic status change over time, there may be a need for a higher concentration of resources necessary to meet the growing demand for services, but not additional stations. The most prominent reason that the geographic distribution model would need to be updated are for changes in traffic impedance that significantly limit the historical average travel speed. Monitoring travel time performance, system reliability, and call concurrency will provide timely feedback for changes in the environment that could impact the distribution model.

Finally, while the number of calls has increased each year from 2013 through 2015, the annual time on task has fluctuated and 2015 is less than 2013. Assuming that future demands will be reasonably distributed across the various stations in the system, the system should be stable through 2021. An average growth of 2% was utilized as a constant or linear projection for future call volume. If the 2% remains over the next five years, there will be an increase of approximately 1,355 requests for service, or less than 4 per day. While the system should be evaluated continuously for performance and desired outcomes, the department should specifically re-evaluate workload and performance indicators for every 1,000-call increase to ensure system stability. Data is presented below.

Table 93: Number of Calls, Number of Responses, and Total Busy Time by Year

Year	Number of Calls	Number of Responses	Average Responses per Call	Total Busy Hours	Average Busy Minutes per Response
2013	10,373	12,983	1.3	3,896	18.0
2014	10,471	12,692	1.2	3,234	15.3
2015	10,738	13,409	1.2	3,669	16.4

Figure 78: Growth Projections through 2021 with 2% Average Growth



The long-term implications for the Department are that they could reduce their capital requirements and re-allocate duplicative resources to increase the concentration at the remaining stations. This is an efficient method to provide flexibility for the Department to handle growth in the demand for

services. Of course, if the Department's geographic size changes in the future, an analysis would have to be completed. In this manner, as long as the geographic demand of the Department remains the same, and maintains the current capability to travel on the road network, the model will be stable and sustainable and additional concentrations of resources can be added as the demand for services increases over time.

Similarly, the appropriate use of a medical priority dispatching system, would serve to cost-avoid future investments in deployment related services as both EMS, and specifically, lower acuity calls are the fastest growing area for community demand for services.

Long-Term Sustainability through Prevention Efforts

A final component that is missing from the risk reduction and mitigation strategies for the City lay with the utilization of a commercial and residential sprinkler program. Many occupancies in the downtown corridor and off-campus multi-room occupancies are unprotected by sprinkler systems. An effective strategy would be to enact a sprinkler retrofit program that can be systematically implemented that will significantly reduce the impact of fire incidents, improve the life safety of building occupants, reduce firefighter risk, and reduce potential exposure fires in close proximity.

Sprinkler and smoke alarm programs have proven to be the most effective method in reducing the loss of life and property due to the incident of fire and will serve to reduce and/or control the growth of the community's fire related resources. It is an effective strategy with a high return on investment for the future.

Attachment A

Data Report

FITCH
& ASSOCIATES

August 2016

Standard of Cover Study

Final Data Analysis

Chico Fire Department
Chico, California

Prepared by:

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CONSULTANT REPORT

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METHODOLOGY

We collected three different data sets: 2013-2015 of CAD data, 2013 SunGard NFIRS data and 2014 and 2015 ERS NFIRS data. We cross-validated CAD and NFIRS databases. In this report, we primarily focused our analysis on the 2015 calendar year. We discussed three years' baseline workload and response time performances in the last section.

In this report, we utilized two distinct measures of call volume and workload. First, is the number of requests for service that are defined as either "dispatches" or "calls". Dispatches/calls are the number of times a distinct incident was created involving Chico Fire Department units or Calls in Chico Fire Department's jurisdiction. Conversely, "responses" are the number of times that an individual unit (or units) responded to a call. Responses will be utilized on all Unit and Station level analyses, which account for all elements of workload and performance. Calls have been categorized as EMS, Fire, Rescue, Hazard, Mutual aid, and Canceled, respectively. We classified call types in a series of steps. We first identified cancelled calls requiring either the NFIRS incident type indicating canceled calls or all dispatched Chico units had identical unit arriving on scene time and unit available time (zero on task time). Then we identified mutual aid calls from Chico Fire Department's perspective using the NFIRS mutual aid, CAD jurisdiction and call disposition data. Then, we used NFIRS incident type to assign EMS, MVA, fire category, rescue, and HazMat call types. Lastly, for NFIRS EMS calls, we used the CAD call description to assign granular EMS categories. For calls, which were missing NFIRS reports, CAD call description was used to assign call type.

Since 2015, most of out of county mutual aid responses were tracked manually as HR records, and thus excluded in this data report. In the majority body of the report, we only discuss calls with at least one dispatched Chico unit. In Table 26, we discuss interactions between Chico Fire Department and County Fire Department. Currently, the CAD data only captures the time a dispatcher created the call, not the time a citizen dialed 911. The dispatch time or alarm handling time in this report is defined as the interval from the call entry time to the unit dispatched time, which only accounts for a portion of the whole dispatch process. Thus, the response time does not include the time from a citizen dialed 911 through the time a dispatcher entered the request into CAD.

COMMUNITY RESPONSE HISTORY

In the year of 2015, Chico Fire Department (CFD) responded to a total of 10,738 requests for service, or dispatches. EMS service requests totaled 6,824, accounting for 63.6% of the total number of incidents. The number of fire related calls were 1,959, which accounted for 18.2% of the dispatched incidents. Canceled calls accounted for 12.7% of the total. A total of 493 incidents (4.6 percent) were mutual aids in the county jurisdiction.

The number of individual unit responses will be more reflective of total department workload since 14 percent of the calls resulted in multiple units dispatched. As summarized in Table 2, all units in CFD combined made 13,409 responses, and were busy on emergency calls 3,669 hours. On average, each response lasted 16.4 minutes from dispatched to clear.

Table 1: Number of Incidents Dispatched by Category

Call Category	Number of Calls	Calls per Day	Call Percentage
Cardiac and stroke	590	1.6	5.5%
Seizure and unconsciousness	894	2.4	8.3%
Breathing difficulty	653	1.8	6.1%
Overdose and psychiatric	376	1.0	3.5%
MVA	601	1.6	5.6%
Fall and injury	1,032	2.8	9.6%
Illness and other	2,678	7.3	24.9%
EMS Total	**6,824**	**18.7**	**63.6%**
Structure fire	92	0.3	0.9%
Outside fire	268	0.7	2.5%
Vehicle fire	26	0.1	0.2%
False alarm	436	1.2	4.1%
Good intent	98	0.3	0.9%
Public service	727	2.0	6.8%
Fire other	312	0.9	2.9%
Fire Total	**1,959**	**5.4**	**18.2%**
Rescue	**11**	**0.0**	**0.1%**
Hazmat	**86**	**0.2**	**0.8%**
Mutual aid	**493**	**1.4**	**4.6%**
Canceled	**1,365**	**3.7**	**12.7%**
Total	**10,738**	**29.4**	**100.0%**

Figure 1: Percentage of Total Incidents Dispatched by Program

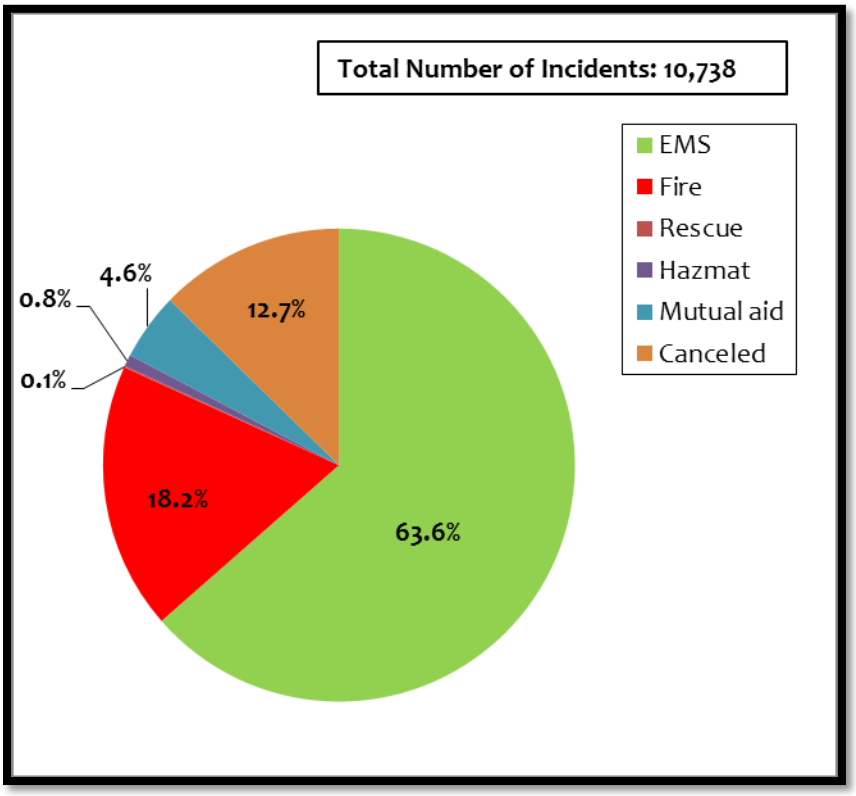


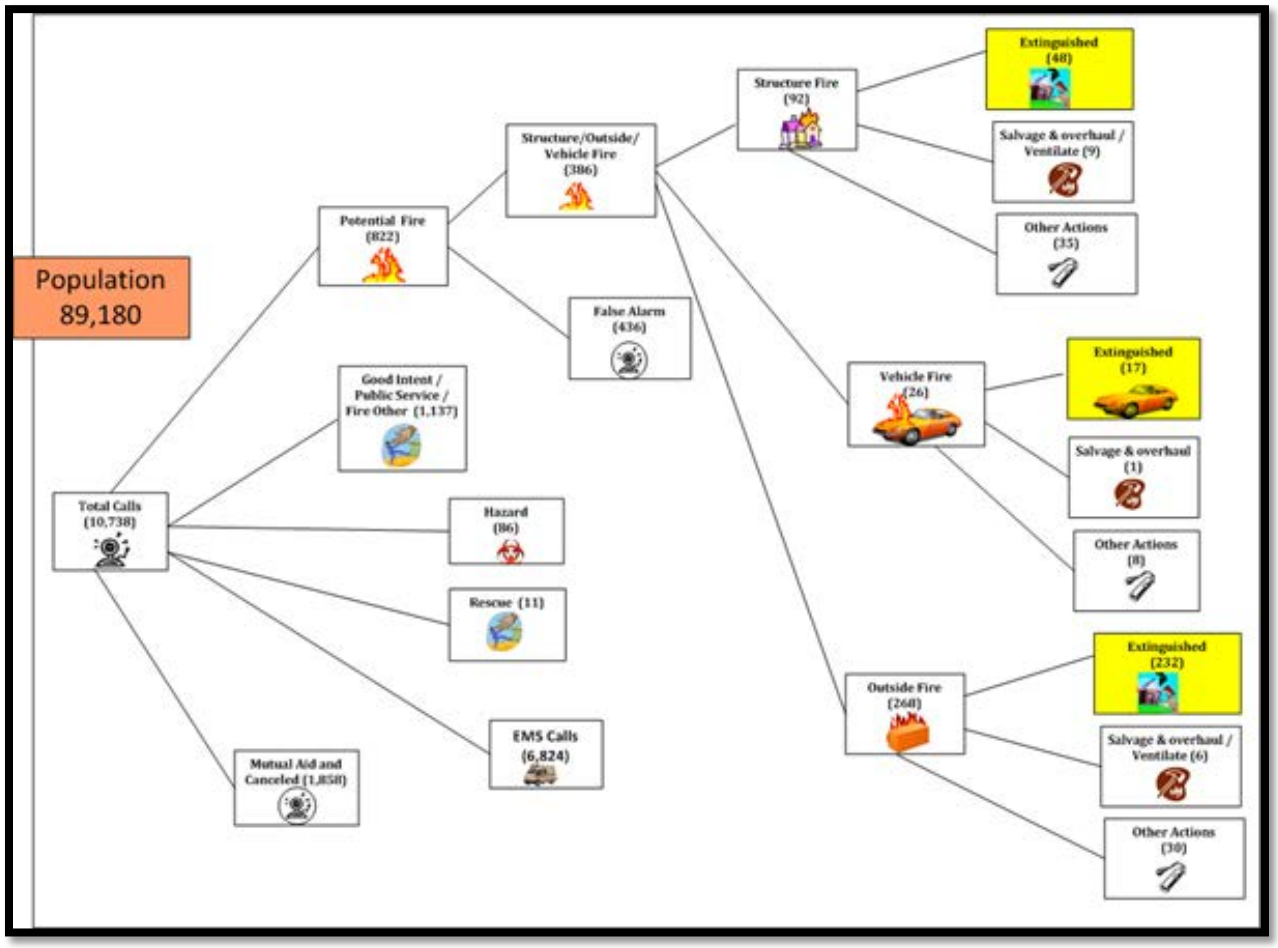
Table 2: Number of Calls, Number of Responses, and Total Busy Time by Program

Program	Number of Calls	Number of Responses	Average Responses per Call	Total Busy Hours	Average Busy Minutes per Response	Percentage of Total Busy Hours
EMS	6,824	7,673	1.1	1,837	14.4	50.0%
Fire	1,959	3,183	1.6	1,171	22.1	31.9%
Rescue	11	23	2.1	24	62.3	0.7%
Hazmat	86	293	3.4	156	31.9	4.3%
Mutual aid	493	631	1.3	252	24.0	6.9%
Canceled	1,365	1,606	1.2	228	8.5	6.2%
Total	**10,738**	**13,409**	**1.2**	**3,669**	**16.4**	**100%**

The US Census estimates the Chico 2014 population was 89,180. We presented all incidents in a tree structure and combine the actions taken information for structure fire, outside fire and vehicle fire calls. The detailed actions taken analysis is presented in Figure 2.

Figure 2: Overviews of 2015 Calls

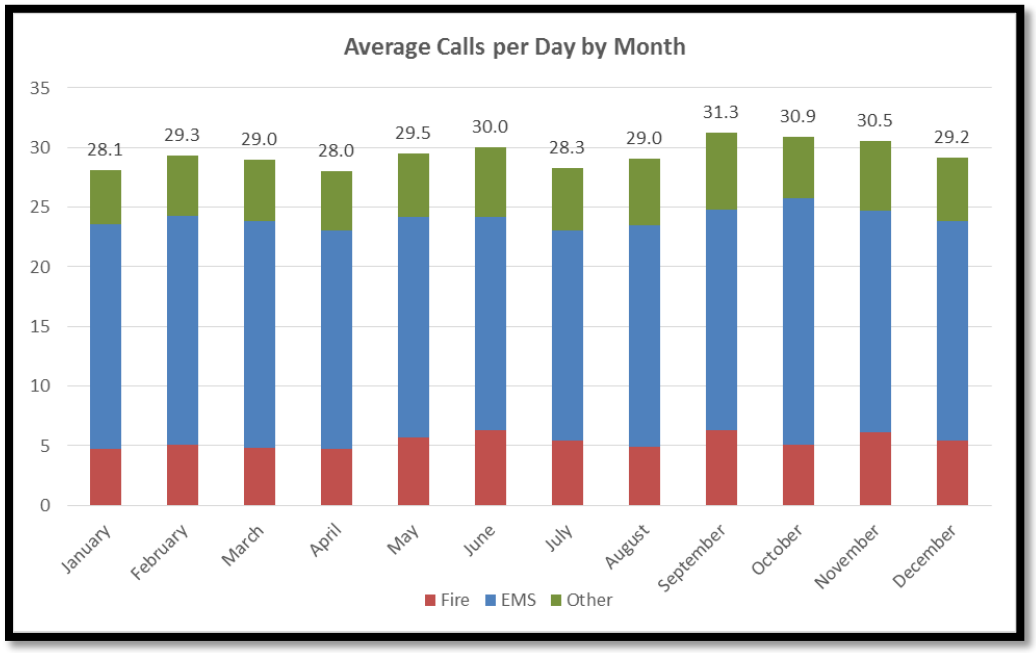
One Year Total Calls (10,738)	= 29.4 per day
➔EMS Calls (4,723)	= 18.7 per day
➔Structure Fire Calls (92)	= 1 every 4.7 days
➔Outside Fire Calls (268)	= 1 every 1.4 days
➔Vehicle Fire Calls (26)	= 1 every two weeks



Temporal analyses were conducted to evaluate patterns in community demands. These measures examined the frequency of requests for service by month, day of week, and hour of day. In the following temporal analysis, rescue, hazmat, mutual aid and canceled calls were grouped into the other category for presentation purpose.

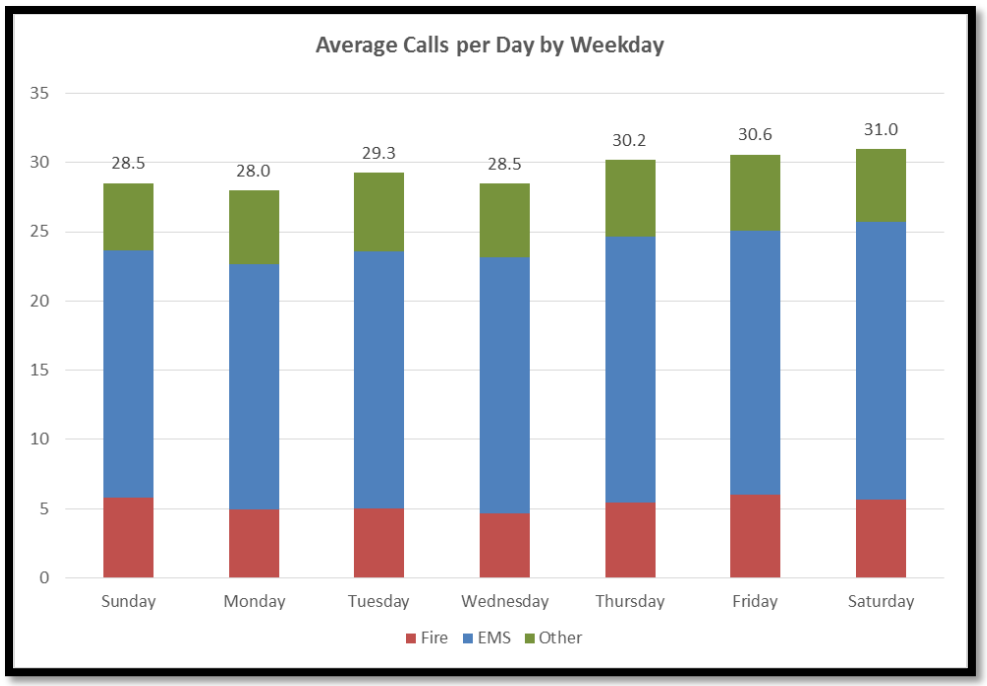
Overall, average requests per month ranged from a low of 28.0 per day in April to a high of 31.3 per day in September. The top three months with the most demands in the descending order are: September (31.3 per day), October (30.9 per day) and November (30.5 per day).

Figure 3: Overall: Average Calls per Day by Month



Similar analyses were conducted for requests by day of week. The data revealed that there is little variability in the demand for services by day of week. Monday was the lowest for the week at 1,455 calls or 28.0 calls per day. Saturday has the highest frequency of requests for services at 1,610 calls or 31.0 calls per day.

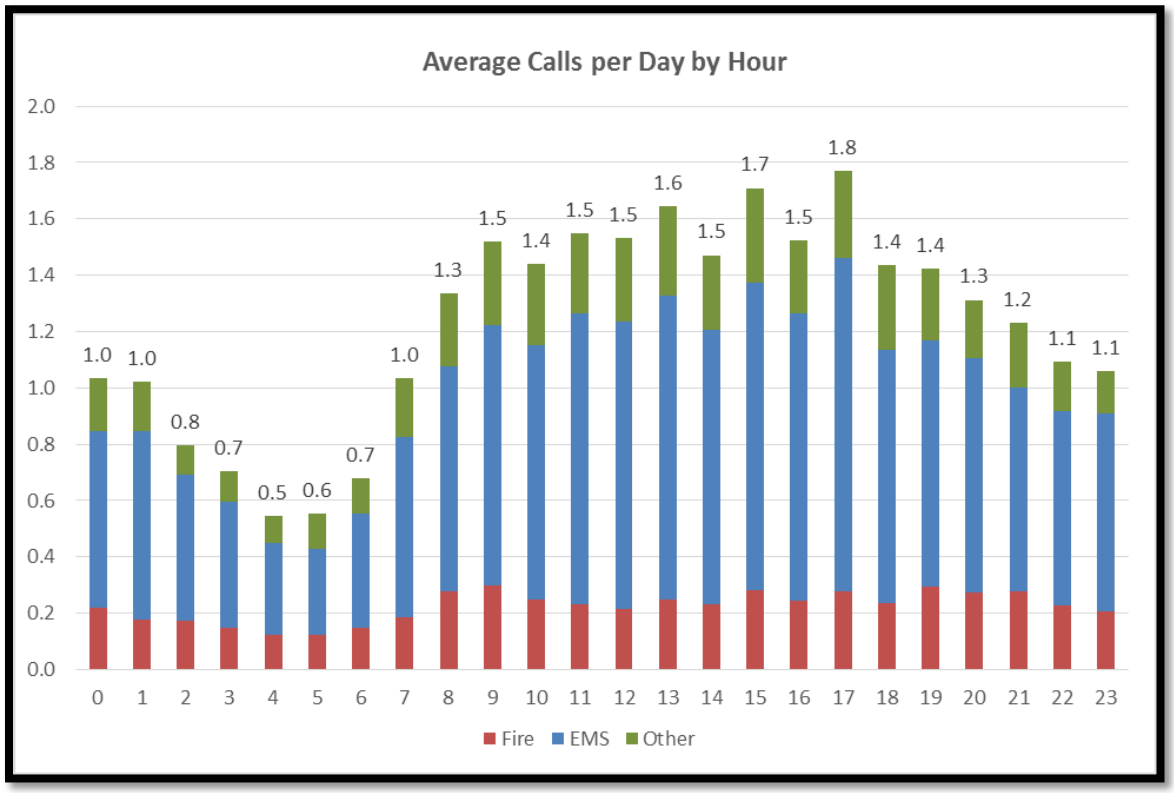
Figure 4: Overall: Average Calls per Day by Weekday



Overall demands were evaluated by the hour of the day. Considerable variability exists in the time of day that requests for emergency services are received. The hours that include 0200 to 0600 are below one standard deviation for this data set. While the middle of the day has the greatest frequency of calls, specifically the hours that begin at 0900 and 1900 are above 500 calls in a year. The average number of calls per hour is 447. The data illustrates that the busiest times of the day are between 0900 and 1900. The hour with the peak demand is at 1700.

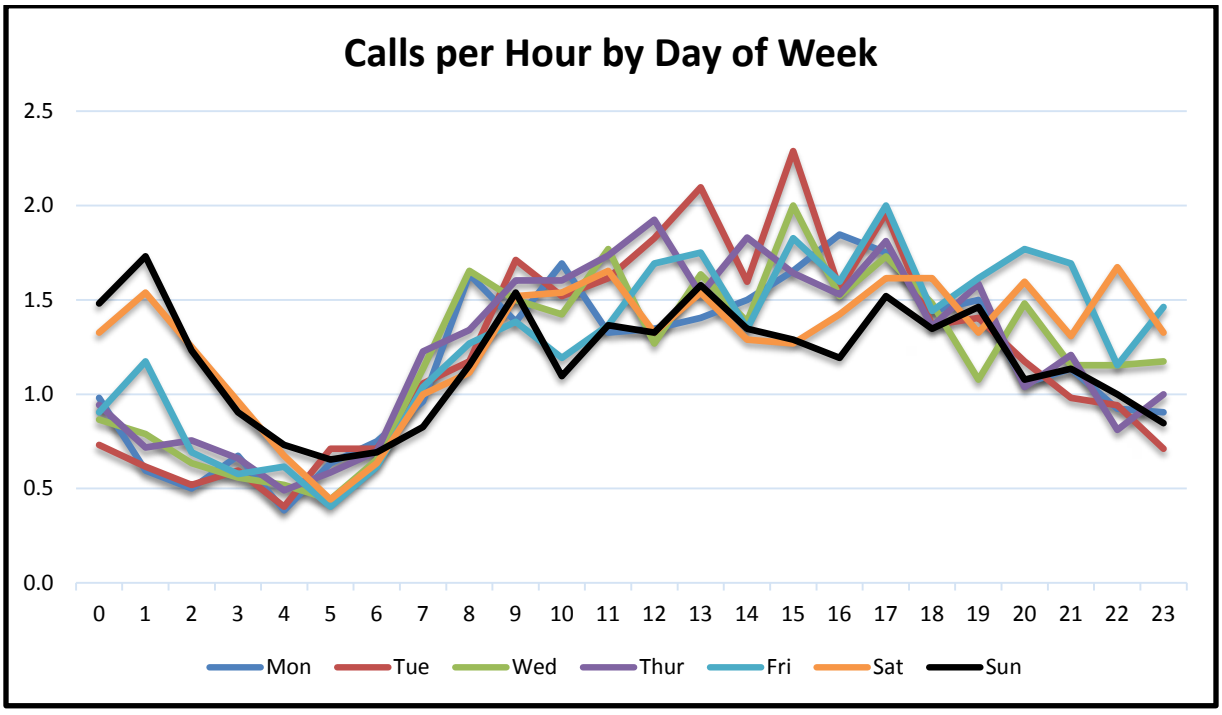
To provide a more granular understanding of the community's demand for emergency services, this temporal analysis included the average number of calls per hour. In other words, when referring to the figure below, the busiest hour is at 1700 with 646 calls during that hour. The average number of calls per hour is a daily average for those 646 calls if they were equally distributed. Therefore, the busiest hour per day would be at 1700 with an average hourly call volume at 1.8 calls per day. The second busiest hour is at 1500 with 624 calls during the hour, and averaged 1.7 calls per hour.

Figure 5: Overall: Average Calls per Day by Hour



Further analyses were conducted to determine if variations existed in the distribution of calls by hour of day and by day of week. This more granular approach reveals that the "weekends" (Thursday through Saturday) have a higher call rate than the rest of the week and approaches two calls per hour on Saturday and Sunday. This analysis utilizes the full 24 hours and not the shift schedule. For example, when referring to Figure 6 below, the Saturday value of 1.5 calls per hour at 0100 is the overnight period after midnight of "Friday's" shift.

Figure 6: Average Calls per Hour by Day of Week



Overall, CFD's units made 13,409 unit responses, and the total busy hours were 3,669 hours. Station 1 staffs T1 24/7 and strategically staff SQ1; and the other five stations (2-6) staff one 24/7 unit and utilize other units as needed. The exception is Station 3 staffed with only one person and does not regularly respond away from the airport. The station level demand is more reflective for deployment decisions. The unit level workload will help evaluate the utilizations of physical apparatus, and help apparatus procurement or maintenance decisions. Stations 1, 2 and 6 were the top three busiest stations. E2R2 and T1 each made more than 2,000 responses, SQ1, E4, E5 and E6 each made 1,623, 1,616, 1701 and 1,981 responses.

Table 3: Overall Workload by Station

Station	Avg. Busy Minutes per Response	Annual Busy Hours	Annual Total Responses
1	13.3	890	4,017
2	14.9	824	3,324
3*	35.3	199	339
4	17.2	462	1,617
5	20.4	592	1,744
6	16.2	536	1,983
Admin	25.9	166	385
Total	**16.4**	**3,669**	**13,409**

*Note: * - Staffed with 1 person at airport and does not respond throughout the city in a similar fashion as the other stations.*

The analysis for calls per hour by day of week assumes that each call either lasts one hour in duration or occurs simultaneously for all events. However, as noted in Table 3 above, the average duration for each response is 16 minutes and 24 seconds (16.4 minutes). In other words, on average, each unit has the potential to respond to four unique incidents per hour, which reduces the overall resource allocation to cover the demand for services. A normalized demand curve is provided below that accounts for the 16.4-minute average duration.

Figure 7: Normalized Hourly Demand by Day of Week

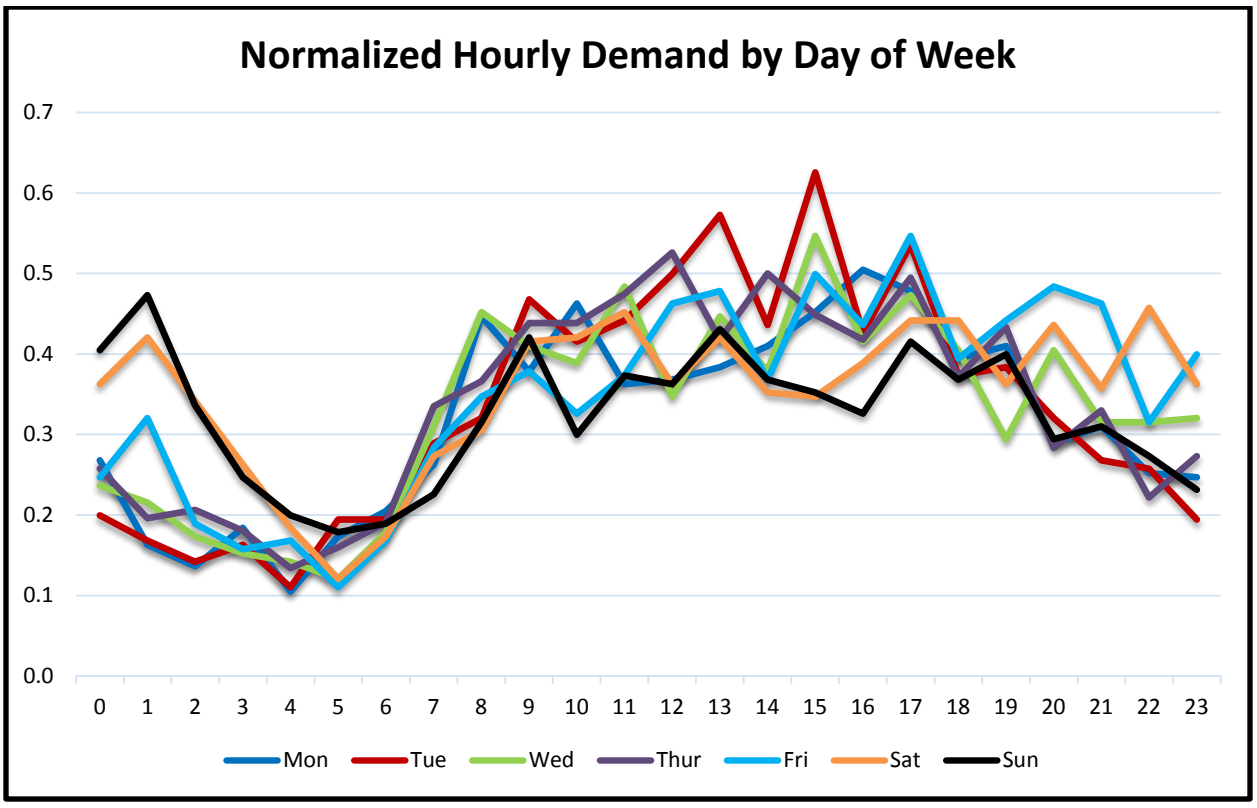


Table 4: Overall Workload by Unit

Station	Apparatus	Apparatus Type	Avg. Busy Minutes per Response	Annual Busy Hours	Annual Total Responses
1	T1	Truck	13.0	517	2,382
	SQ1	Squad	13.3	361	1,623
	BS1	Breathing Support	86.2	10	7
	UT1	Utility	22.6	2	5
	Station 1 Total		**13.3**	**890**	**4,017**
	E2	Engine	14.8	813	3295
	UT2	Utility	21	7	19
	R2	Rescue	25	4	10
	Station 2 Total		**14.9**	**824**	**3,324**
	E3CR3	Engine or Crash Rescue	34.9	189	325
	UT3	Utility	45.5	11	14
	Station 3 Total		**35.3**	**199**	**339**
4	E4	Engine	17.2	462	1,617
	Station 4 Total		**17.2**	**462**	**1,617**
5	E5	Engine	18.3	519	1,701
	HM5	Hazmat	111.8	43	23
	E15	Wild Land Engine	88.3	29	20
	Station 5 Total		**20.4**	**592**	**1,744**
6	E6	Engine	16.2	536	1,982
	UT6	Utility	11	0	1
	Station 6 Total		**16.2**	**536**	**1,983**
Admin	D2	Division Chief Vehicle	25.1	45	108
	D4	Division Chief Vehicle	21.6	34	95
	D1	Division Chief Vehicle	33.7	43	77
	D3	Division Chief Vehicle	30.3	32	64
	CF1	Chief Vehicle	7.8	2	15
	CF2	Chief Vehicle	27.9	5	11
	CF4	Chief Vehicle	21.2	4	11
	CF3	Chief Vehicle	2.6	0	4
	Admin Total		**25.9**	**166**	**385**
CFD Total			**16.4**	**3,669**	**13,409**

Currently, the CAD data only captures the time a dispatcher created the call, not the time a citizen dialed 911. The dispatch time or alarm handling time in this report is defined as the interval from the call entry time to the unit dispatched time, which only accounts for a portion of the whole dispatch process. Thus, the response time does not include the time from a citizen dialed 911 through the time a dispatcher entered the request into CAD.

This analysis focused on lights and sirens responses and utilized the first arriving units of all distinct incidents excluding mutual aid and canceled incidents. The mean (average) dispatch time was 42 seconds. The mean (average) turnout time was 66 seconds (one minute and 6 seconds), travel time was 204 seconds (three minutes 24 seconds), turnout and travel time was 264 seconds (four minutes 24 seconds), and response time was 312 seconds (five minutes and 12 seconds). The average response time is the same as the sum of the average dispatch time and turnout and travel time.

However, a more conservative and reliable measure of performance is the fractile or percentile. This measure is more robust, or less influenced by outliers, than measures of central tendency such as the mean. Best practice is to measure at the 90th percentile. In other words, 90% of all performance is captured expecting that 10% of the time the department may experience abnormal conditions that would typically be considered an outlier. For example, if the department were to report an average response time of six minutes, then in a normally distributed set of data, half of the responses would be longer than six minutes and half of the responses would be less than six minutes. The 90th percentile communicates that 9 out of 10 times the department performance is predictable and thus more clearly articulated to policy makers and the community.

The performance for dispatch time at the 90th percentile was 82 seconds (one minute and 22 seconds), turnout time at the 90th percentile was 118 seconds (one minutes and 58 seconds), travel time was 316 seconds (five minutes and 16 seconds), turnout and travel time was 395 seconds (six minutes and 35 seconds), and response time was 440 seconds (seven minutes and 20 seconds). Please note that the summation of 90th percentile turnout time and 90th percentile travel time is not the same as 90th percentile turnout and travel time combined, and also the summation of 90th percentile dispatch time, 90th percentile turnout time and 90th percentile travel time is not the same as 90th percentile response time.

Typically, performance varies across call types or categories due to a variety of reasons. For example, the turnout time may be longer for fire related calls because the crews have to dress in their personal protective ensemble (bunker gear) prior to leaving the station where as on an EMS incident they do not. Similarly, the larger fire apparatus may require longer response times due to their size and lack of maneuverability. However, these data only includes emergency responses; data does suggest mean and 90th percentile turnout time for fire calls were slightly longer than EMS calls. As expected, significant variability is introduced in responses for rescue and hazmat calls. Since there are only 5 rescue calls used in this analysis, the 90th percentile is essential the longest time.

Table 5: Average Dispatch, Turnout and Travel Time of First Arriving Units by Program

Program	Dispatch Time	Turnout Time	Travel Time	Turnout and Travel	Response Time	Sample Size
EMS	0.7	1.0	3.3	4.3	5.0	6,592
Fire	0.9	1.2	3.7	5.0	5.8	1,171
Rescue	1.0	0.9	4.2	5.1	6.1	5
Hazmat	1.1	1.2	3.7	4.8	5.9	74
Total	**0.7**	**1.1**	**3.4**	**4.4**	**5.2**	**7,842**

Figure 8: Average Turnout and Travel Time by Call Category

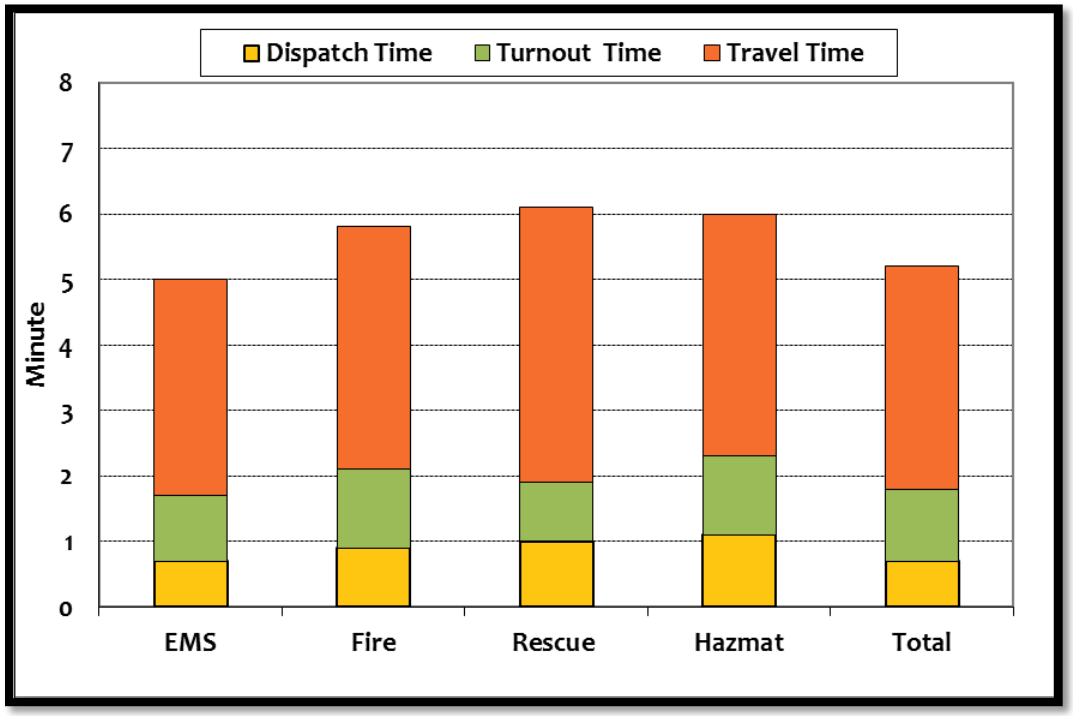


Table 6: 90th Percentile Turnout and Travel Time of First Arriving Units by Program

Program	Dispatch Time	Turnout Time	Travel Time	Turnout and Travel	Response Time	Sample Size
EMS	1.3	1.9	5.1	6.4	7.2	6,592
Fire	1.7	2.2	6.0	7.4	8.4	1,171
Rescue	1.5	1.5	8.4	9.9	11.1	5
Hazmat	2.8	2.0	5.4	7.1	7.8	74
Total	**1.4**	**2.0**	**5.3**	**6.6**	**7.3**	**7,842**

Figure 9: Fractile Distribution Histogram for Turnout Time

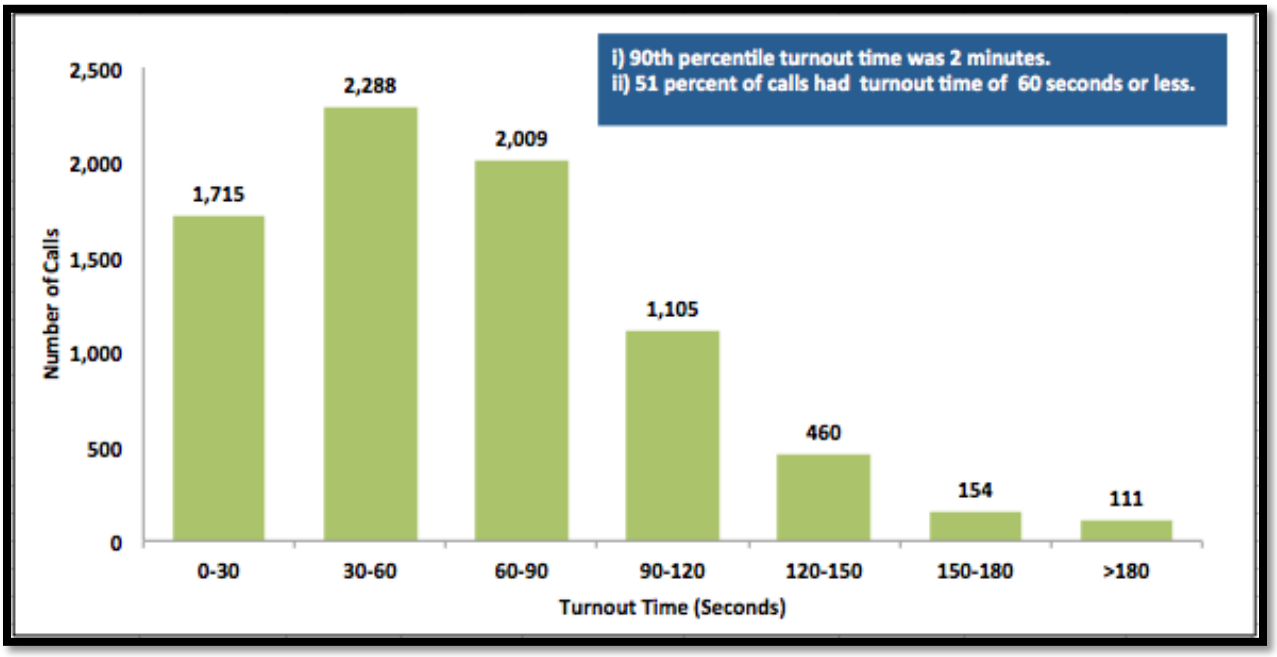
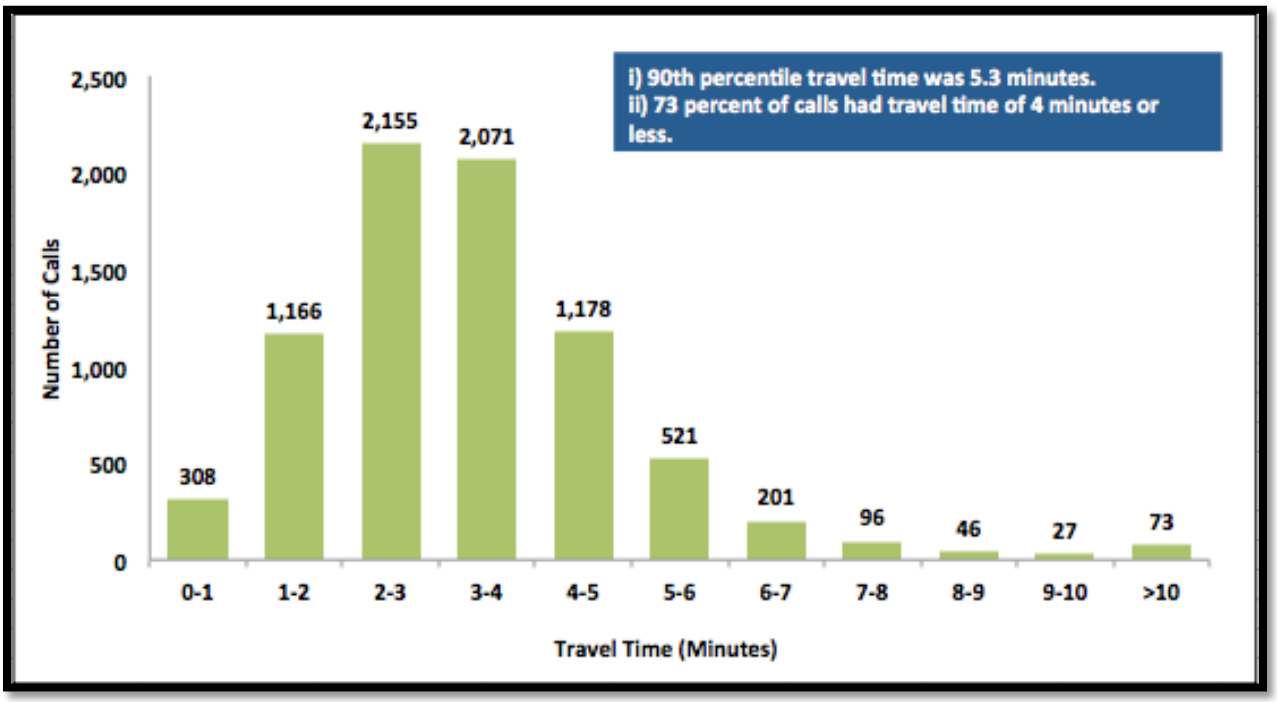


Figure 10: Fractile Distribution Histogram for Travel Time



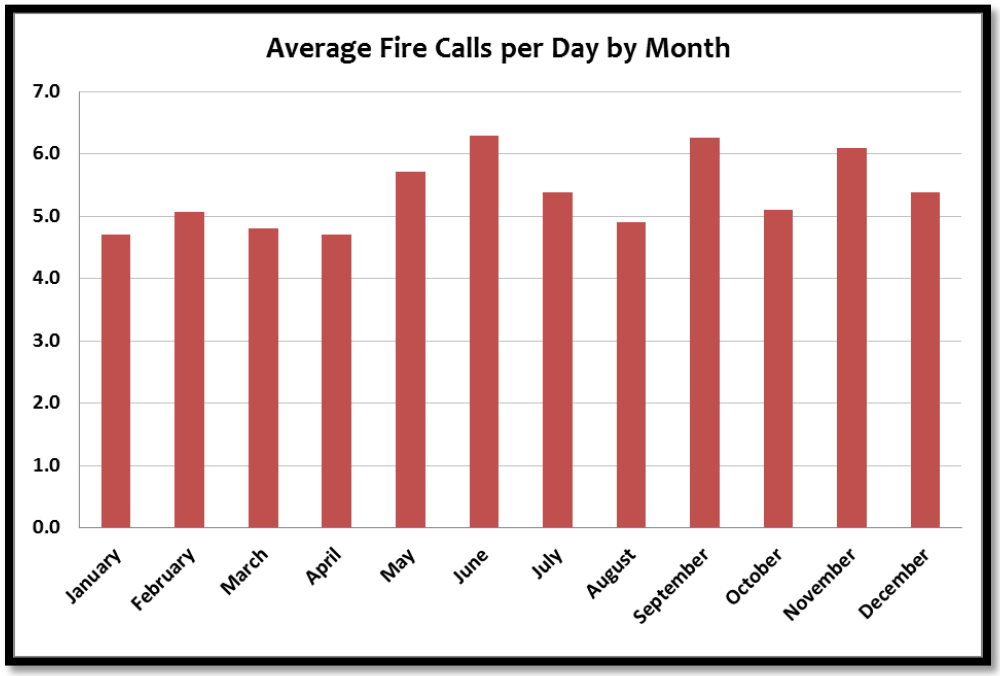
Fire Services

Temporal analyses were conducted to evaluate patterns in community demands for fire related services. These measures examined the frequency of requests for service in 2015 Fiscal year by month, day of week, and hour of day. Results found that there was variability by month. The three months with most fire calls in order were: June (6.3 per day), September (6.3 per day), and November (6.1 per day). The three months with least fire calls in order were: April (4.7 per day), January (4.7 per day), and March (4.8 per day). Results are presented below in Table 7 and Figure 11.

Table 7: Total Fire Related Calls per Month

Month	Number of Calls	Calls per Day	Call Percentage
January	146	4.7	7.5
February	142	5.1	7.2
March	149	4.8	7.6
April	141	4.7	7.2
May	177	5.7	9.0
June	189	6.3	9.6
July	167	5.4	8.5
August	152	4.9	7.8
September	188	6.3	9.6
October	158	5.1	8.1
November	183	6.1	9.3
December	167	5.4	8.5
Total	**1,959**	**5.4**	**100.0**

Figure 11: Average Fire Related Calls per Month

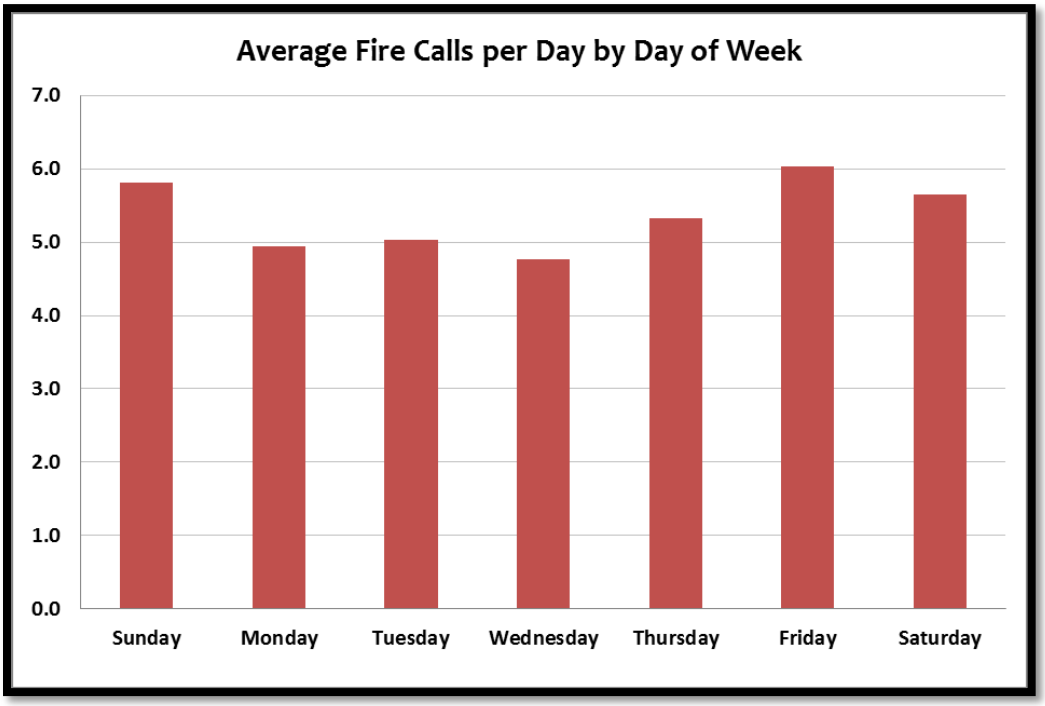


Similar analyses were conducted for fire related calls per day of week. The data revealed that there is little variability in the demand for services by day of week. Wednesday was the lowest for the week, averaging 4.8 per day or 12.7 percent of the fire related calls for the week. Friday has the highest frequency of requests for fire related services averaging 6.0 calls per day and 16.0%. Results for this analysis are presented below in Table 8 and Figure 12.

Table 8: Total Fire Related Calls by Day of Week

Day of Week	Number of Calls	Calls per Day	Call Percentage
Sunday	302	5.8	15.4
Monday	257	4.9	13.1
Tuesday	262	5.0	13.4
Wednesday	248	4.8	12.7
Thursday	282	5.3	14.4
Friday	314	6.0	16.0
Saturday	294	5.7	15.0
Total	**1,959**	**5.4**	**100.0**

Figure 12: Average Fire Related Calls by Day of Week for 2014



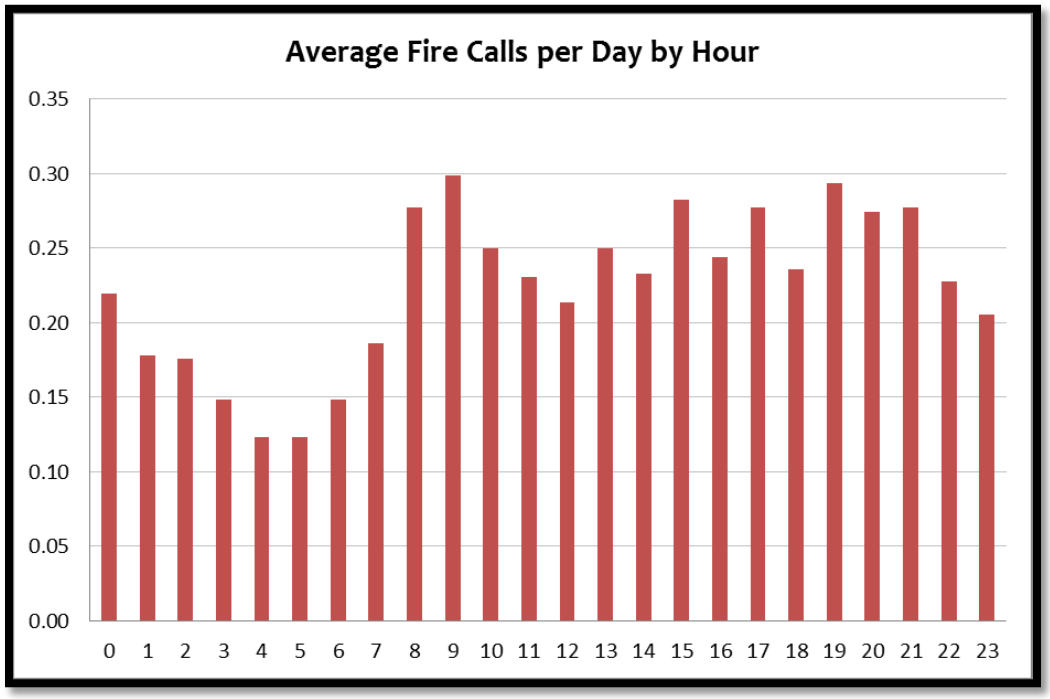
Fire related calls were evaluated by hour of the day. Considerable variability exists in the time of day that requests for fire related services are received. The hours that include midnight to 0600 have the lowest demands. While the middle of the day has the greatest frequency of calls, specifically the 13 hours period from 0900 through 2200 are above 145 calls in a year. The average number of calls per

hour in a year is 132. The data illustrates that the busiest times of the day for fire related incidents are between 0800 and 2100. The seven hours at 0800, 0900, 1500, 1700, 1900, 2000 and 2100 had more than 100 calls in a year. In the seven hours period from 0100 to 0700, a total of 395 calls occurred in a year, which averaged 1.1 calls per day. Finally, in an effort to provide a more granular understanding of the community's demand for fire related services, this temporal analysis included the average number of calls per hour. In other words, when referring to the Table below, the busiest hour is at 0900 with 109 calls during that hour in 2015. The average number of calls per hour is a daily average for those 109 calls if they were equally distributed. Therefore, the busiest hour per day would be at 0900 with an average hourly call volume of less than 1 at 0.30 calls per hour. Below are the results in Table 9 and Figure 13.

Table 9: Total and Average Fire Related Calls by Hour of Day for 2014

Hour of Day	Number of Calls	Calls per Hour	Call Percentage
0	80	0.22	4.1
1	65	0.18	3.3
2	64	0.18	3.3
3	54	0.15	2.8
4	45	0.12	2.3
5	45	0.12	2.3
6	54	0.15	2.8
7	68	0.19	3.5
8	101	0.28	5.2
9	109	0.30	5.6
10	91	0.25	4.6
11	84	0.23	4.3
12	78	0.21	4.0
13	91	0.25	4.6
14	85	0.23	4.3
15	103	0.28	5.3
16	89	0.24	4.5
17	101	0.28	5.2
18	86	0.24	4.4
19	107	0.29	5.5
20	100	0.27	5.1
21	101	0.28	5.2
22	83	0.23	4.2
23	75	0.21	3.8
Total	**1,959**	**5.37**	**100.0**

Figure 13: Average Fire Related Calls per Day by Hour of Day in 2014



For these analyses, "Fire Related" incidents are an aggregated category of the various final incident types available in the NFIRS databases. Public service was the most frequent community demand (averaging at 2.0 requests per day), followed by false alarm (averaging at 1.2 requests per day). Responses to structure, outside, vehicle and marine fires totaled 386 (averaging about 1.1 per day), and outside fire is the largest category of the three. Of the 140 fire incidents, which were missing NFIRS reports, 104 were airport runway check incidents, mostly responded by the crash rescue in station 3.

Table 10: Total Fire Related Calls by NFIRS Incident Type

NFIRS Incident Type	Number of Calls	Percentage of Total Fire Service Demands
100 - Fire, other	118	6.0
111 - Building fire	39	2.0
112 - Fires in structure other than in a building	3	0.2
113 - Cooking fire, confined to container	35	1.8
114 - Chimney or flue fire, confined to chimney or flue	2	0.1
116 - Fuel burner/boiler malfunction, fire confined	1	0.1
118 - Trash or rubbish fire, contained	7	0.4
120 - Fire in mobile prop. used as a fixed struc., other	2	0.1
122 - Fire in motor home, camper, recreational vehicle	1	0.1
123 - Fire in portable building, fixed location	1	0.1
130 - Mobile property (vehicle) fire, other	2	0.1
131 - Passenger vehicle fire	20	1.0
132 - Road freight or transport vehicle fire	1	0.1
136 - Self-propelled motor home or recreational vehicle	1	0.1
137 - Camper or recreational vehicle (RV) fire	1	0.1
140 - Natural vegetation fire, other	18	0.9
141 - Forest, woods or wildland fire	4	0.2
142 - Brush or brush-and-grass mixture fire	7	0.4
143 - Grass fire	15	0.8
150 - Outside rubbish fire, other	17	0.9
151 - Outside rubbish, trash or waste fire	19	1.0
154 - Dumpster or other outside trash receptacle fire	54	2.8
155 - Outside stationary compactor/compacted trash fire	1	0.1
160 - Special outside fire, other	10	0.5
161 - Outside storage fire	1	0.1
162 - Outside equipment fire	3	0.2
173 - Cultivated trees or nursery stock fire	1	0.1
200 - Overpressure rupture, explosion, overheat other	3	0.2
210 - Overpressure rupture from steam, other	1	0.1
240 - Explosion (no fire), other	2	0.1
243 - Fireworks explosion (no fire)	5	0.3
251 - Excessive heat, scorch burns with no ignition	24	1.2
400 - Hazardous condition, other	43	2.2
430 - Radioactive condition, other	1	0.1
440 - Electrical wiring/equipment problem, other	28	1.4
441 - Heat from short circuit (wiring), defective/worn	2	0.1
442 - Overheated motor	2	0.1
443 - Breakdown of light ballast	2	0.1
444 - Power line down	46	2.3
445 - Arcing, shorted electrical equipment	22	1.1
460 - Accident, potential accident, other	10	0.5
462 - Aircraft standby	4	0.2
4620 - Aircraft Standby Other	1	0.1
4623 - Engine Malfunction	2	0.1
4628 - Smoke/Fumes In Aircraft	1	0.1
463 - Vehicle accident, general cleanup	15	0.8
480 - Attempted burning, illegal action, other	9	0.5
481 - Attempt to burn	4	0.2
500 - Service Call, other	28	1.4
510 - Person in distress, other	42	2.1
511 - Lock-out	18	0.9
512 - Ring or jewelry removal	1	0.1
520 - Water problem, other	29	1.5

NFIRS Incident Type	Number of Calls	Percentage of Total Fire Service Demands
521 - Water evacuation	2	0.1
522 - Water or steam leak	29	1.5
531 - Smoke or odor removal	15	0.8
540 - Animal problem, other	1	0.1
541 - Animal problem	1	0.1
542 - Animal rescue	9	0.5
550 - Public service assistance, other	99	5.1
551 - Assist police or other governmental agency	36	1.8
552 - Police matter	31	1.6
553 - Public service	96	4.9
554 - Assist invalid	164	8.4
555 - Defective elevator, no occupants	5	0.3
561 - Unauthorized burning	61	3.1
600 - Good intent call, other	44	2.2
631 - Authorized controlled burning	8	0.4
650 - Steam, other gas mistaken for smoke, other	4	0.2
651 - Smoke scare, odor of smoke	28	1.4
652 - Steam, vapor, fog or dust thought to be smoke	2	0.1
653 - Smoke from barbecue, tar kettle	8	0.4
671 - HazMat release investigation w/no HazMat	4	0.2
700 - False alarm or false call, other	98	5.0
710 - Malicious, mischievous false call, other	8	0.4
711 - Municipal alarm system, malicious false alarm	3	0.2
714 - Central station, malicious false alarm	2	0.1
715 - Local alarm system, malicious false alarm	6	0.3
721 - Bomb scare - no bomb	5	0.3
730 - System malfunction, other	22	1.1
731 - Sprinkler activation due to malfunction	1	0.1
733 - Smoke detector activation due to malfunction	51	2.6
734 - Heat detector activation due to malfunction	7	0.4
735 - Alarm system sounded due to malfunction	20	1.0
736 - CO detector activation due to malfunction	29	1.5
740 - Unintentional transmission of alarm, other	17	0.9
741 - Sprinkler activation, no fire - unintentional	2	0.1
742 - Extinguishing system activation	1	0.1
743 - Smoke detector activation, no fire - unintentional	112	5.7
744 - Detector activation, no fire - unintentional	15	0.8
745 - Alarm system activation, no fire - unintentional	33	1.7
746 - Carbon monoxide detector activation, no CO	4	0.2
800 - Severe weather or natural disaster, other	4	0.2
900 - Special type of incident, other	1	0.1
911 - Citizen complaint	2	0.1

CFD made a total of 3,183 responses to fire related calls. The total time on task was 1,171 hours, and the average time on task was 22.1 minutes. Of the six regularly staffed fire suppression apparatus (engine or truck), E2 is the most utilized unit in fire related calls, followed by T1, E5 and E4.

Table 11: Workload by Unit for Fire Calls

Station	Apparatus	Apparatus Type	Avg. Busy Minutes per Response	Annual Busy Hours	Annual Total Responses
1	BS1	Breathing Support	86.2	10	7
	SQ1	Squad	16.3	66	243
	T1	Truck	18.1	188	622
	UT1	Utility	8.8	0	3
	Station 1 Total		**18.1**	**265**	**875**
2	E2	Engine	19.8	219	665
	R2	Rescue	23.2	1	2
	UT2	Utility	11.5	2	9
	Station 2 Total		**19.7**	**222**	**676**
	E3CR3	Engine or Crash Rescue	38.4	158	247
	UT3	Utility	56.9	8	8
	Station 3 Total		**39**	**166**	**255**
4	E4	Engine	**21.8**	**123**	**339**
5	E15	Wildland Engine	63.2	5	5
	E5	Engine	22.8	151	399
	HM5	Hazmat	33.7	4	7
	Station 5 Total		**23.4**	**161**	**411**
	E6	Engine	21.1	137	388
	UT6	Utility	11	0	1
	Station 6 Total		**21.1**	**137**	**389**
Admin	CF1	Chief Vehicle	7.8	1	11
	CF2	Chief Vehicle	32	5	9
	CF3	Chief Vehicle	1.4	0	3
	CF4	Chief Vehicle	31.9	3	6
	D1	Division Chief Vehicle	27	20	45
	D2	Division Chief Vehicle	24.3	26	63
	D3	Division Chief Vehicle	37.3	26	41
	D4	Division Chief Vehicle	18.1	18	60
	Admin Total		**24.9**	**99**	**238**
CFD Total			**22.1**	**1,171**	**3,183**

We analyzed property and content loss information. A total of 154 or 40% of the structure fire, outside fire or vehicle fire calls have recorded a property loss, and the total property loss is $1.35 million. A total of 83 or 22% of the structure fire, outside fire or vehicle fire calls have recorded content loss, and the total content loss is $0.41 million.

Table 12: Property and Content Loss by Call Type

Call Type	Property Loss			Content Loss		
	Dollar Amount	Average Loss per Call	Number of Calls	Dollar Amount	Average Loss per Call	Number of Calls
Structure fire	$1,146,470	$31,846	36	$346,335	$9,114	38
Outside fire	$62,990	$630	100	$54,720	$1,440	38
Vehicle fire	$136,400	$7,578	18	$10,200	$1,457	7
Total	**$1,345,860**	**$8,739**	**154**	**$411,255**	**$4,955**	**83**

Three primary actions taken have been tracked in the department's NFIRS software; the analysis below tabulates the actions taken for structure fire, outside fire and vehicle fire calls. A total of 48 structure fires, 232 outside fires, and 17 vehicle fires have been extinguished or controlled by Chico firefighters. A total of 14 structure fires, 14 outside fires, and 3 vehicle fires were out on arrival.

Table 13: Actions Taken Analysis for Structure Fire, Outside Fire and Vehicle Fire

Action Taken 1	Action Taken 2	Action Taken 3	Structure Fire	Outside Fire	Vehicle Fire
Fire control or extinguishment, other			12	68	7
Fire control or extinguishment, other	Salvage & overhaul		1	2	0
Fire control or extinguishment, other	Salvage & overhaul	Ventilate	1	0	0
Fire control or extinguishment, other	Establish fire lines (wildfire)	Contain fire (wildland)	0	1	0
Fire control or extinguishment, other	Secure property		1	0	0
Fire control or extinguishment, other	Information, investigation & enforcement, other		1	0	0
Fire control or extinguishment, other	Incident command	Investigate	1	0	0
Fire control or extinguishment, other	Investigate		0	4	0
Extinguishment by fire service personnel			13	131	5
Extinguishment by fire service personnel	Salvage & overhaul		5	6	1
Extinguishment by fire service personnel	Salvage & overhaul	Search	1	0	0
Extinguishment by fire service personnel	Salvage & overhaul	Ventilate	1	0	0
Extinguishment by fire service personnel	Salvage & overhaul	Investigate	2	1	1

Action Taken 1	Action Taken 2	Action Taken 3	Structure Fire	Outside Fire	Vehicle Fire
Extinguishment by fire service personnel	Search		1	0	0
Extinguishment by fire service personnel	Search	Salvage & overhaul	1	0	0
Extinguishment by fire service personnel	Search	Ventilate	1	0	0
Extinguishment by fire service personnel	Remove hazard		0	1	0
Extinguishment by fire service personnel	Ventilate	Investigate	1	0	0
Extinguishment by fire service personnel	Shut down system		1	1	0
Extinguishment by fire service personnel	Information, investigation & enforcement, other		1	1	0
Extinguishment by fire service personnel	Investigate		1	14	2
Extinguishment by fire service personnel	Investigate	Salvage & overhaul	2	0	0
Salvage & overhaul			3	4	0
Salvage & overhaul	Ventilate		1	0	0
Salvage & overhaul	Investigate		1	0	1
Salvage & overhaul	Investigate fire out on arrival		1	1	0
Control fire (wildland)			0	1	0
Identify, analyze hazardous materials			0	1	0
Remove hazard			0	1	0
Fires, rescues & hazardous conditions, other			0	1	0
Ventilate			2	1	0
Evacuate area	Establish safe area	Refer to proper authority	0	1	0
Information, investigation & enforcement, other			0	1	0
Incident command	Extinguishment by fire service personnel	Investigate	0	0	1
Enforce codes	Investigate		0	1	0
Investigate			13	10	5
Investigate	Fire control or extinguishment, other		0	1	0
Investigate	Salvage & overhaul		2	0	0
Investigate	Ventilate		3	0	0
Investigate	Ventilate	Shut down system	1	0	0
Investigate	Restore fire alarm system		1	0	0
Investigate	Shut down system		1	0	0
Investigate	Enforce codes		0	1	0
Investigate fire out on arrival			12	12	3
Investigate fire out on arrival	Ventilate		1	0	0
Investigate fire out on arrival	Enforce codes		0	1	0

Emergency Medical Services

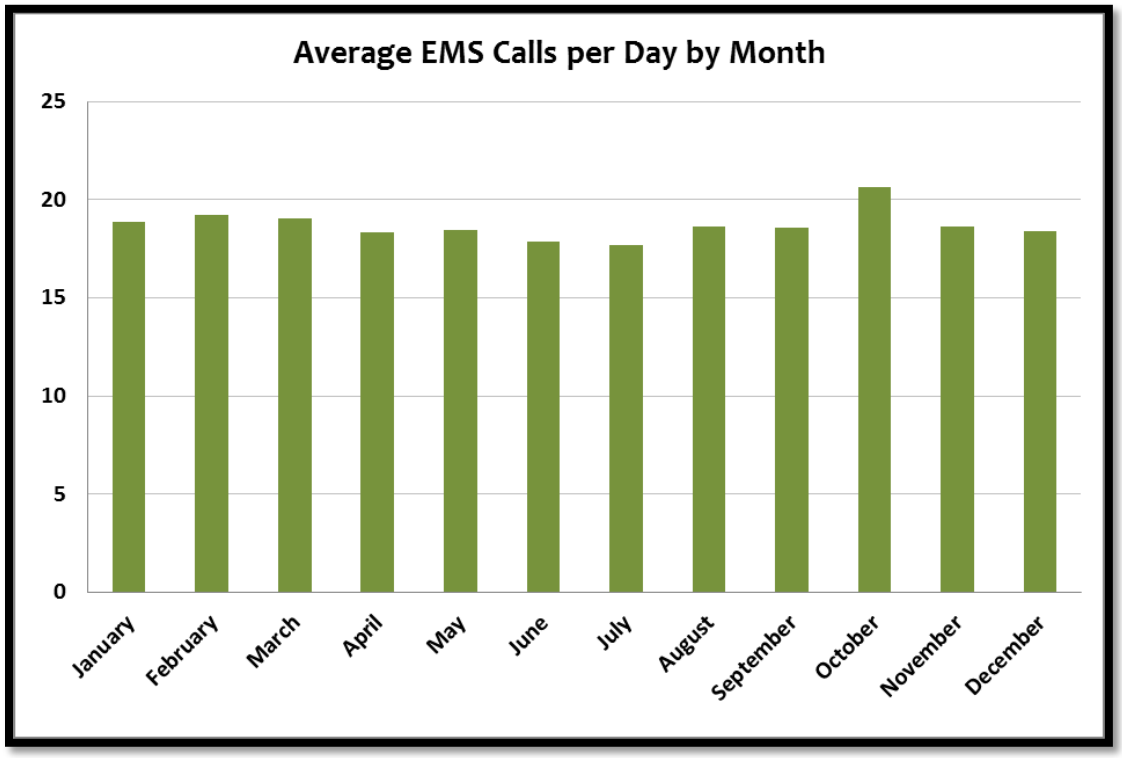
CFD provide emergency Medical Services (EMS). Requests for EMS are categorized as granular call categories using the initial CAD call description. Private ambulance companies provide patient transport services to local hospitals.

Temporal analyses were completed to describe the community's demands for emergency medical services. These analyses were completed by month of year, day of week, and hour of day. There is minor variability between months of the year with October (20.6 EMS requests per day) receiving the most requests for service and July (17.7 EMS requests per day) the least. Results are presented in tabular form as Table 14 and Figure 14 below.

Table 14: Annual Total and Average per Day of EMS Calls by Month of Year

Month	Number of Calls	Calls per Day	Call Percentage
January	586	18.9	8.6
February	538	19.2	7.9
March	590	19.0	8.6
April	550	18.3	8.1
May	572	18.5	8.4
June	536	17.9	7.9
July	548	17.7	8.0
August	577	18.6	8.5
September	557	18.6	8.2
October	640	20.6	9.4
November	559	18.6	8.2
December	571	18.4	8.4
Total	**6,824**	**18.7**	**100.0**

Figure 14: Average EMS Calls per Day by Month of Year

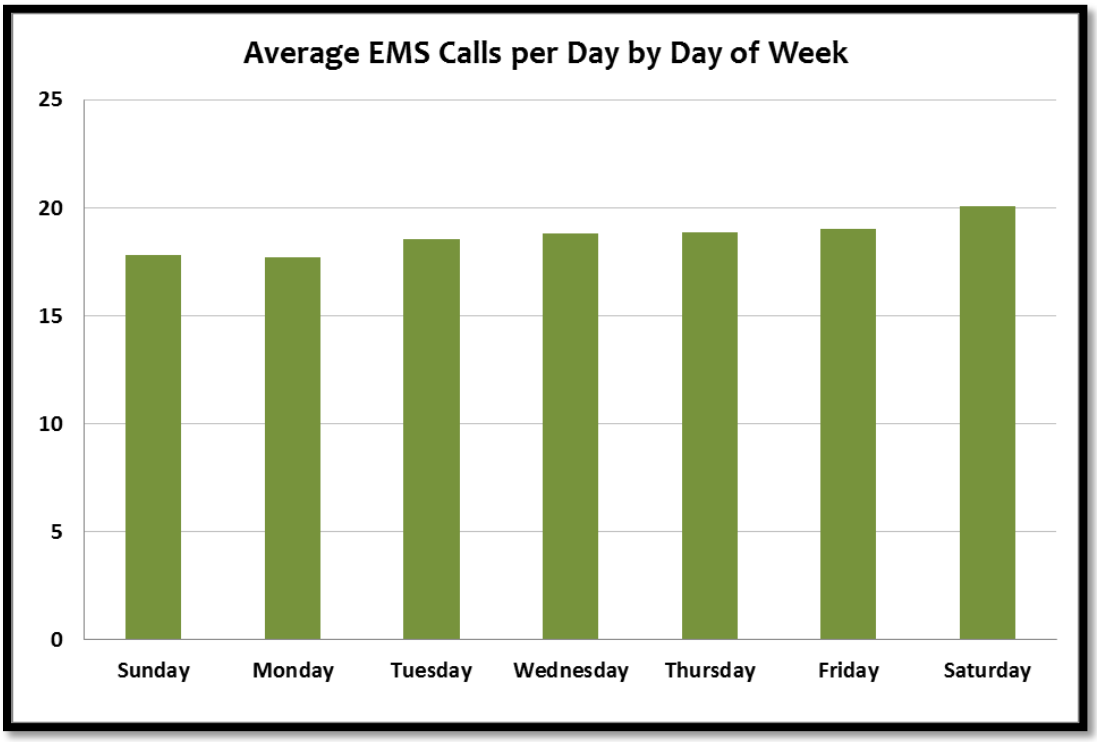


Similar analyses were conducted examining the frequency of requests for service by the day of the week. Once again, there is only minor variability in the demand for services by the day of the week. Saturday receives the most requests for service and Monday the least. Results are provided below as Table 15 and Figure 15, respectively.

Table 15: Annual Total and Average per Day of EMS Calls by Day of Week

Day of Week	Number of Calls	Calls per Day	Call Percentage
Sunday	927	17.8	13.6
Monday	922	17.7	13.5
Tuesday	964	18.5	14.1
Wednesday	979	18.8	14.3
Thursday	999	18.8	14.6
Friday	989	19.0	14.5
Saturday	1,044	20.1	15.3
Total	**6,824**	**18.7**	**100.0**

Figure 15: Average EMS Calls per Day by Day of Week

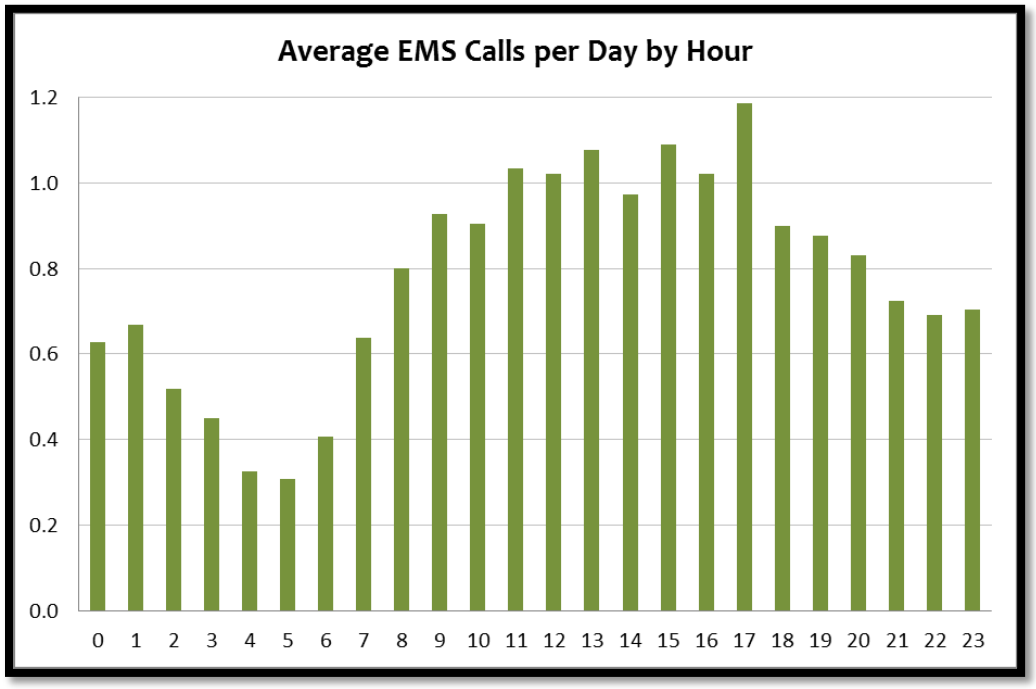


Finally, the analyses for EMS services are concluded by identifying the EMS calls by hour of day and the average hourly rate of EMS calls per hour. The demand curve for requests for EMS service follows an expected pattern experienced in similar communities across the nation. The higher frequency of service calls begins from 0900 to 2000 and each hour had more than 300 calls. The demand peaked at 1700 with 433 calls in a year. The average hourly rate of service requests is 0.78 for any hour during the day with the peak occurring at 1700 at 1.2 calls on average during the hour, and a low at 0500 of 0.31 calls on average during that hour. Results are provided below as Table 16 and Figure 16.

Table 16: Annual Total and Average per Day of EMS Calls by Hour of Day

Hour of Day	Number of Calls	Calls per Hour	Call Percentage
0	229	0.63	3.4
1	244	0.67	3.6
2	189	0.52	2.8
3	164	0.45	2.4
4	119	0.33	1.7
5	112	0.31	1.6
6	148	0.41	2.2
7	233	0.64	3.4
8	292	0.80	4.3
9	338	0.93	5.0
10	330	0.90	4.8
11	377	1.03	5.5
12	373	1.02	5.5
13	393	1.08	5.8
14	355	0.97	5.2
15	398	1.09	5.8
16	373	1.02	5.5
17	433	1.19	6.3
18	328	0.90	4.8
19	320	0.88	4.7
20	303	0.83	4.4
21	264	0.72	3.9
22	252	0.69	3.7
23	257	0.70	3.8
Total	**6,824**	**18.70**	**100.0**

Figure 16: Average EMS Calls per Day by Hour of Day



For these analyses, EMS incidents are an aggregated category of the various granular EMS requests categorized based upon CAD call description. EMS requests accounted for 63.6% of the total requests and averaged 18.7 requests per day. Illness and other was the most frequent community demand (averaging 7.3 requests per day), followed by fall and injury (averaging 2.8 requests per day). Cardiac and stroke requests totaled 590, averaging 1.6 requests per day.

The CFD sends multiple units to 11 percent of the EMS incidents. On average, 1.1 units were dispatched per EMS call. MVA is the category that had 26% of the incidents with more than one Chico unit responding.

CFD units made a total of 7,673 responses to EMS calls. The total time on task was 1,838 hours, and the average time on task was 14.4 minutes. Engine 2 was the most utilized unit in EMS calls, and it made 1,971 responses, and spent 475 hours on task. SQ1 made 1,128 responses and spent 244 hours on task.

Table 17: Workload by Unit for EMS Calls

Station	Apparatus	Apparatus Type	Avg. Busy Minutes per Response	Annual Busy Hours	Annual Total Responses
1	SQ1	Squad	13	244	1,128
	T1	Truck	11.4	247	1,300
	UT1	Utility	29.8	1	1
	Station 1 Total		**12.1**	**491**	**2,429**
2	E2	Engine	14.4	499	2086
	R2	Rescue	34.3	3	5
	UT2	Utility	18.7	2	5
	Station 2 Total		**14.4**	**503**	**2,096**
	E3CR3	Engine or Crash Rescue	19.4	13	41
	UT3	Utility	13.6	1	3
	Station 3 Total		**19**	**14**	**44**
4	E4	Engine	15.3	254	1,000
5	E15	Wildland Engine	25.2	1	2
	E5	Engine	17.4	306	1,055
	Station 5 Total		**17.4**	**307**	**1,057**
6	E6	Engine	**15.1**	**250**	**997**
Admin	CF1	Chief Vehicle	4.9	0	1
	CF4	Chief Vehicle	6.7	0	3
	D1	Division Chief Vehicle	30.9	8	16
	D2	Division Chief Vehicle	19	4	11
	D3	Division Chief Vehicle	17.8	3	10
	D4	Division Chief Vehicle	21.9	3	9
	Admin Total		**22**	**18**	**50**
CFD Total			**14.4**	**1,838**	**7,673**

REVIEW OF SYSTEM PERFORMANCE

The first step in determining the current state of the system's deployment model is to establish baseline measures of performance. This analysis is crucial to the ability to discuss alternatives to the status quo and in identifying opportunities for improvement. This portion of the analysis will focus efforts on elements of response time and the cascade of events that lead to timely response with the appropriate apparatus and personnel to mitigate the event. Response time goals should be looked at in terms of total reflex time, or total response time, which includes the dispatch or call processing time, turnout time, and travel time, respectively.

Cascade of Events

The cascade of events is the sum of the individual elements of time beginning with a state of normalcy and continuing until normalcy is once again returned through the mitigation of the event. The elements of time that are important to the ultimate outcome of a structure fire or critical medical emergency begin with the initiation of the event. For example, the first on-set of chest pain begins the biological and scientific time clock for heart damage irrespective of when 911 is notified. Similarly, a fire may begin and burn undetected for a period of time before the fire department is notified. The emergency response system does not have control over the time interval for recognition or the choice to request assistance.

Therefore, CFD utilize quantifiable "hard" data points to measure and manage system performance. These elements include alarm processing (with updated CAD), turnout time, travel time, and the time spent on-scene. An example of the cascade of events and the elements of performance utilized by EFD is provided as Figure 14 below.[1]

Detection

Is the element of time between the time an event occurs and someone detects it and the emergency response system has been notified. This is typically accomplished by calling the 911 Primary Safety Answering Point (PSAP).

Call Processing

This is the element of time measured between when 911 answers the 911 call, processes the information, and subsequently dispatches EFD.

[1] Olathe Fire Department. (2012). Adapted from Community Risk and Emergency Services Analysis: Standard of Cover. Olathe, Kansas: Author.

Turnout Time

This is the element of time that is measured between the time the fire department is dispatched or alerted of the emergency incident and the time when the fire apparatus or ambulance is enroute to the call.

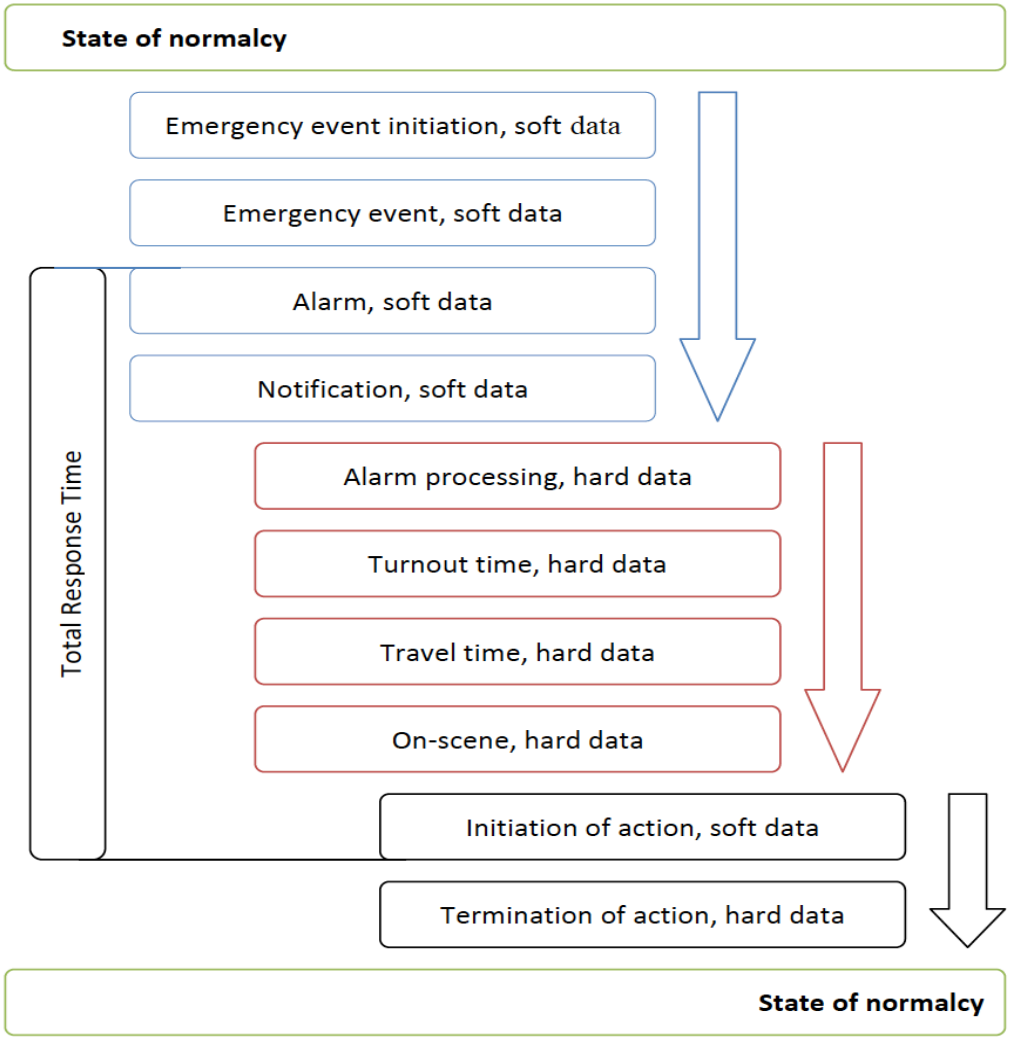
Travel Time

The travel time is the element of time between when the unit went enroute, or began to travel to the incident, and their arrival on-scene.

Total Response Time

The total response time, or total reflex time, is the total time required to arrive on-scene beginning with 911 answering the phone request for service and the time that the units arrive on-scene.

Figure 17: Cascade of Events



Comparison of Workloads by Demand Zone

Another method of assessing the effectiveness of the distribution model is to analyze the demand for services across the distribution model. Workload is assessed at the station demand zone level and at the individual unit level.

Analyses illustrate that Station Demand Zones 1 and 2 were the top demand zones, and each answer 24.0% and 28.4% of the total responses for services. Collectively these two demand zones accounted for 52.4% of the total workload. Station Demand Zone 3 accounted for 2.0% of the total responses for services. Results are presented below as Figure 18 and Table 18.

Figure 18: Department Workload by Station Demand Zone

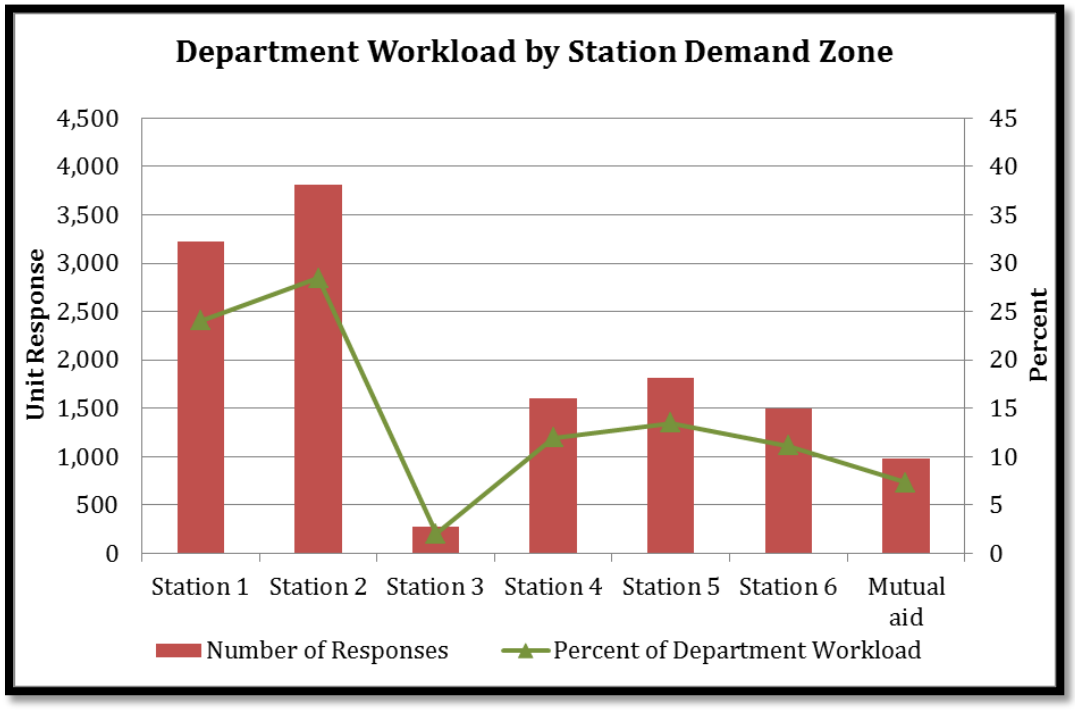


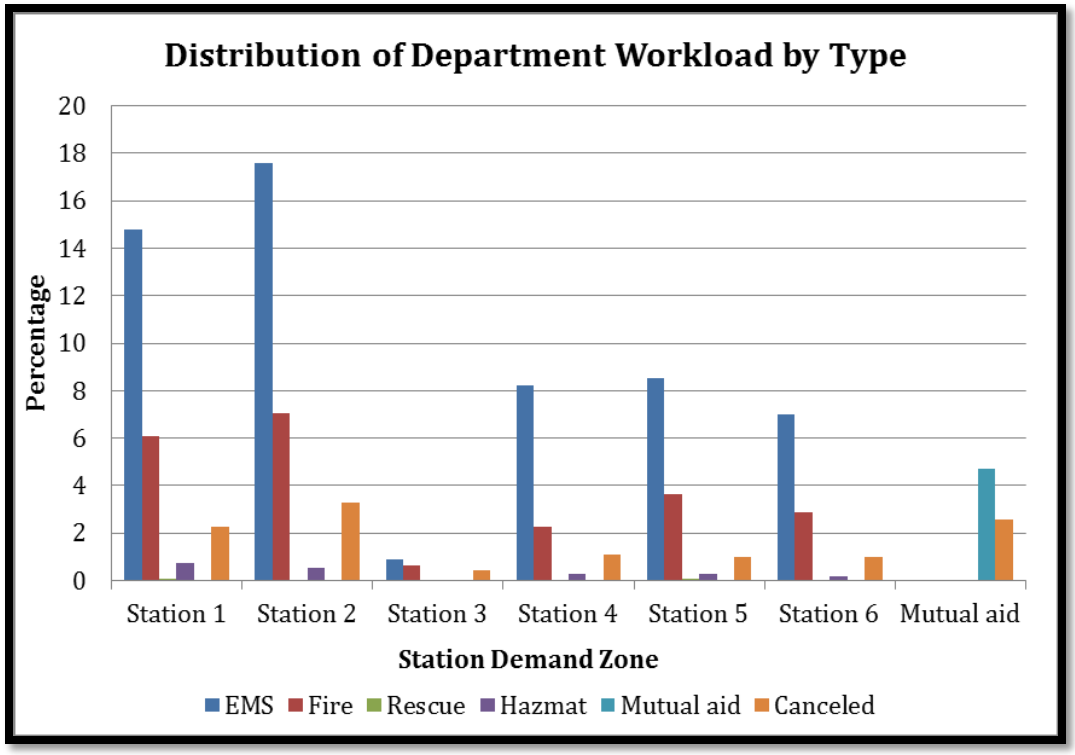
Table 18: Department Workload by Station Demand Zone

Agency	First Due Station	Number of Responses	Responses per Day	Percent of Department Workload
Chico	Station 1	3,220	8.8	24.0
	Station 2	3,813	10.4	28.4
	Station 3	270	0.7	2.0
	Station 4	1,602	4.4	11.9
	Station 5	1,808	5.0	13.5
	Station 6	1,490	4.1	11.1
	Mutual aid	978	2.7	7.3
	Missing	228	0.6	1.7
	Total	**13,409**	**36.7**	**100.0**

Note: 228 unit responses' first due stations can't be identified.

Further analyses were completed identifying both the distribution of department workload by program. The overall distribution of department workload supports earlier findings that greater than 57% of the requests for service are EMS related. Approximately 24% of the unit responses were associated with fire related incidents. Canceled requests accounted for 12% of the total. Rescue and Hazmat programs are very small. For both EMS and fire requests, demand zones 1 and 2 ranked the top.

Figure 19: Distribution of Department Workload by Call Type



The within station analyses did not reveal any significant deviations from the department's overall experience. Findings are presented as Figure 20 below. In addition, the total number of unit responses conducted in each station demand zone is presented below as Table 19.

Figure 20: Within Station Distribution of Department Workload by Call Type

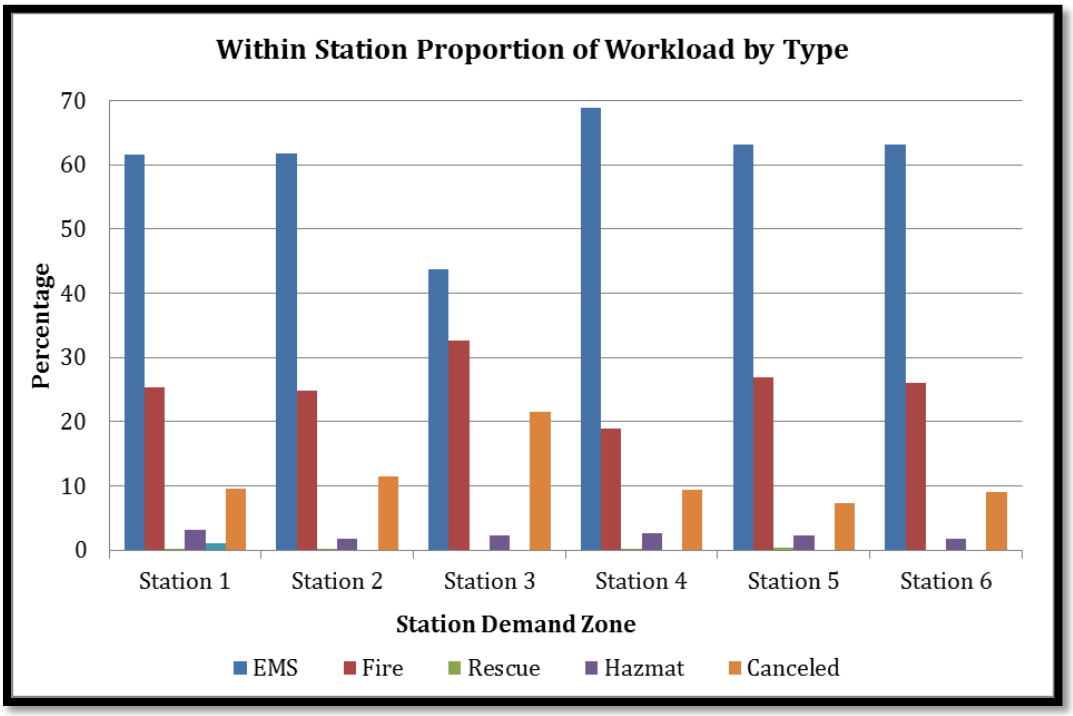


Table 19: Number of Responses by Station Demand Zone and Call Type

First Due Station	EMS	Fire	Rescue	Hazmat	Mutual aid	Canceled	Total
Station 1	1,986	818	8	101	0	307	3,220
Station 2	2,356	946	2	71	0	438	3,813
Station 3	118	88	0	6	0	58	270
Station 4	1,105	303	3	41	0	150	1,602
Station 5	1,141	486	8	40	0	133	1,808
Station 6	941	387	0	27	0	135	1,490
Mutual aid	0	0	0	0	631	347	978
Missing	26	155	2	7	0	38	228
Total	**7,673**	**3,183**	**23**	**293**	**631**	**1,606**	**13,409**

Finally, unit workload analyses were completed for both comparative purposes as well as for introspection into potential system failures. First, this analysis utilized the summation of individual unit workload from dispatch to clear. E2R2 was dispatched the most with a total of 3,101 runs, followed by T1 and E6. The top six most utilized units all made more than 1,600 responses. Crash rescue 3 made 266 responses. Results of the unit workload analysis are presented below as Table 20.

Table 20: Unit Workload Analyses by Unit and Call Category

Station	Unit	Description	EMS	Fire	Rescue	Hazmat	Mutual aid	Canceled	Total
2	E2	Engine	2,086	665	5	40	72	427	3,295
1	T1	Truck	1,300	622	7	54	105	294	2,382
6	E6	Engine	997	388	0	41	236	320	1,982
5	E5	Engine	1,055	399	2	29	43	173	1,701
1	SQ1	Squad	1,128	243	2	19	70	161	1,623
4	E4	Engine	1,000	339	3	35	76	164	1,617
3	E3CR3	Engine or Crash Rescue	41	247	1	14	4	18	325
Admin	D2	Division Chief Vehicle	11	63	1	22	4	7	108
Admin	D4	Division Chief Vehicle	9	60	0	12	1	13	95
Admin	D1	Division Chief Vehicle	16	45	1	4	3	8	77
Admin	D3	Division Chief Vehicle	10	41	0	7	2	4	64
5	HM5	Hazmat	0	7	0	8	6	2	23
5	E15	Wild Land Engine	2	5	0	1	5	7	20
2	UT2	Utility	5	9	0	1	1	3	19
Admin	CF1	Chief Vehicle	1	11	0	1	2	0	15
3	UT3	Utility	3	8	1	2	0	0	14
Admin	CF2	Chief Vehicle	0	9	0	0	1	1	11
Admin	CF4	Chief Vehicle	3	6	0	1	0	1	11
2	R2	Rescue	5	2	0	1	0	2	10
1	BS1	Breathing Support	0	7	0	0	0	0	7
1	UT1	Utility	1	3	0	0	0	1	5
Admin	CF3	Chief Vehicle	0	3	0	1	0	0	4
6	UT6	Utility	0	1	0	0	0	0	1

Another measure, time on task, is necessary to evaluate best practices in efficient system delivery and consider the impact workload has on personnel. Unit Hour Utilization (UHU) determinants were developed by mathematical model. This model includes both the proportion of calls handled in each major service area (Fire, EMS, Special-Ops, and Service) and total unit time on task for these service categories in 2014. The resulting UHU's represent the percentage of the work period (24 hours) that is utilized responding to requests for service. Historically, the International Association of Fire Fighters (IAFF) has recommended that 24-hour units utilize 0.30, or 30% workload as an upper

threshold.[2] In other words this recommendation would have personnel spend no more than eight (8) hours per day on emergency incidents. These thresholds take into consideration the necessity to accomplish non-emergency activities such as training, health and wellness, public education, and fire inspections. The 4th edition of the IAFF EMS Guidebook no longer specifically identifies an upper threshold. However, *FITCH* recommends that an upper unit utilization threshold of approximately .30, or 30%, would be considered best practice. In other words, units and personnel should not exceed 30%, or eight (8) hours, of their workday responding to calls. These recommendations are also validated in the literature. For example, in their review of the City of Rolling Meadows, the Illinois Fire Chiefs Association utilized a UHU threshold of .30 as an indication to add additional resources.[3] Similarly, in a standards of cover study facilitated by the Center for Public Safety Excellence, the Castle Rock Fire and Rescue Department utilizes a UHU of .30 as the upper limit in their standards of cover due to the necessity to accomplish other non-emergency activities.[4]

These thresholds take into consideration the necessity to accomplish non-emergency activities such as training, health and wellness, public education, and fire inspections.

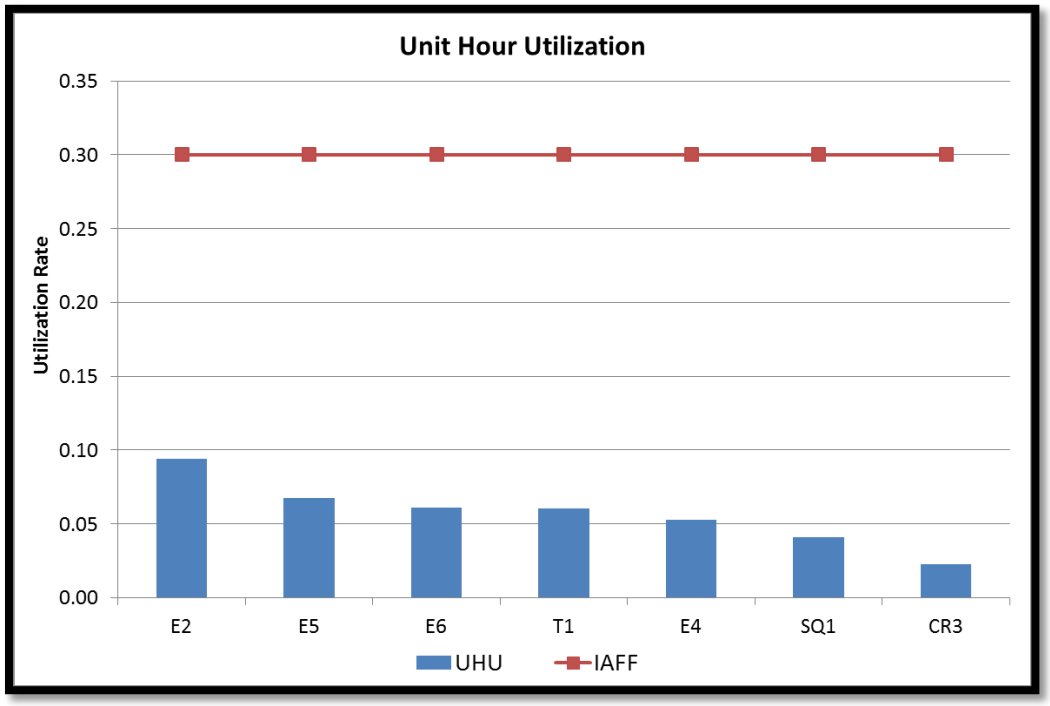
Since stations 2-6 only can staff one unit at a time, the station total workload is grouped into E2, CR3, E4, E5 and E6 to calculate unit utilization. In station 1, all unit hours except SQ1 were grouped into T1.

In CFD, the most utilized units E2 and E5. The least utilized unit was crash rescue 3. All unit utilizations were below 10%. This is partly contributed by the relative short average time on task of 16.4 minutes.

At the current workload utilization rates, CFD should have limited impact on their level or readiness or system performance.

[2] International Association of Firefighters. (1995). Emergency *Medical Services: A Guidebook for Fire-Based Systems.* Washington, DC: Author. (p. 11)
[3] Illinois Fire Chiefs Association. (2012). An *Assessment of Deployment and Station Location: Rolling Meadows Fire Department.* Rolling Meadows, Illinois: Author. (pp. 54-55)
[4] Castle Rock Fire and Rescue Department. (2011). Community *Risk Analysis and Standards of Cover.* Castle Rock, Colorado: Author. (p. 58)

Figure 21: Unit Hour Utilization



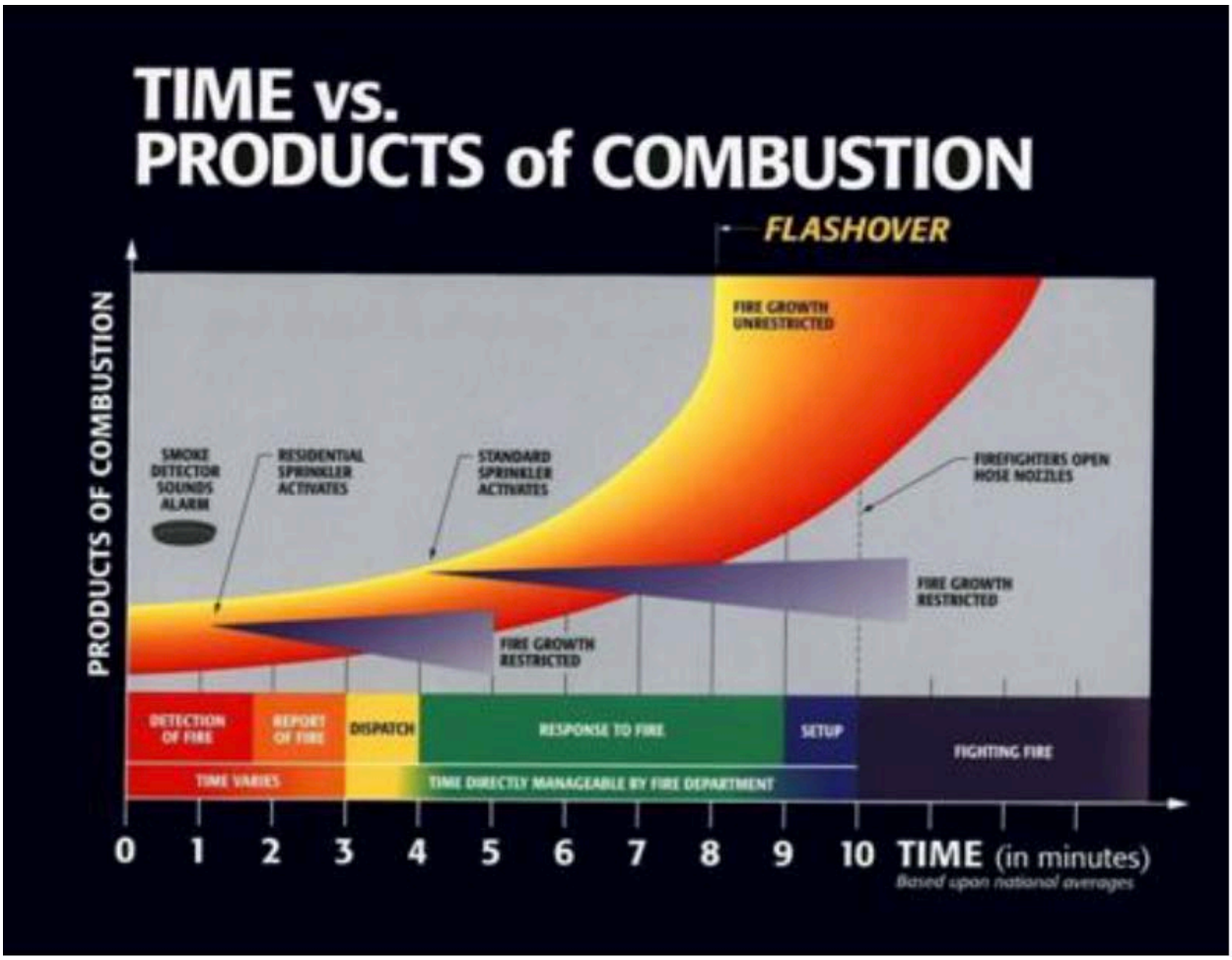
RESPONSE TIME CONTINUUM

Fire

The number one priority with structural fire incidents is to save lives followed by the minimization of property damage. A direct relationship exists between the timeliness of the response and the survivability of unprotected occupants and property damage. The most identifiable point of fire behavior is Flashover.

Flashover is the point in fire growth where the contents of an entire area, including the smoke, reach their ignition temperature, resulting in a rapid-fire growth rendering the area un-survivable by civilians and untenable for firefighters. Best practices would result in the fire department arriving and attacking the fire prior to the point of flashover. A representation of the traditional time temperature curve and the cascade of events are provided as Figure 22 below.[5]

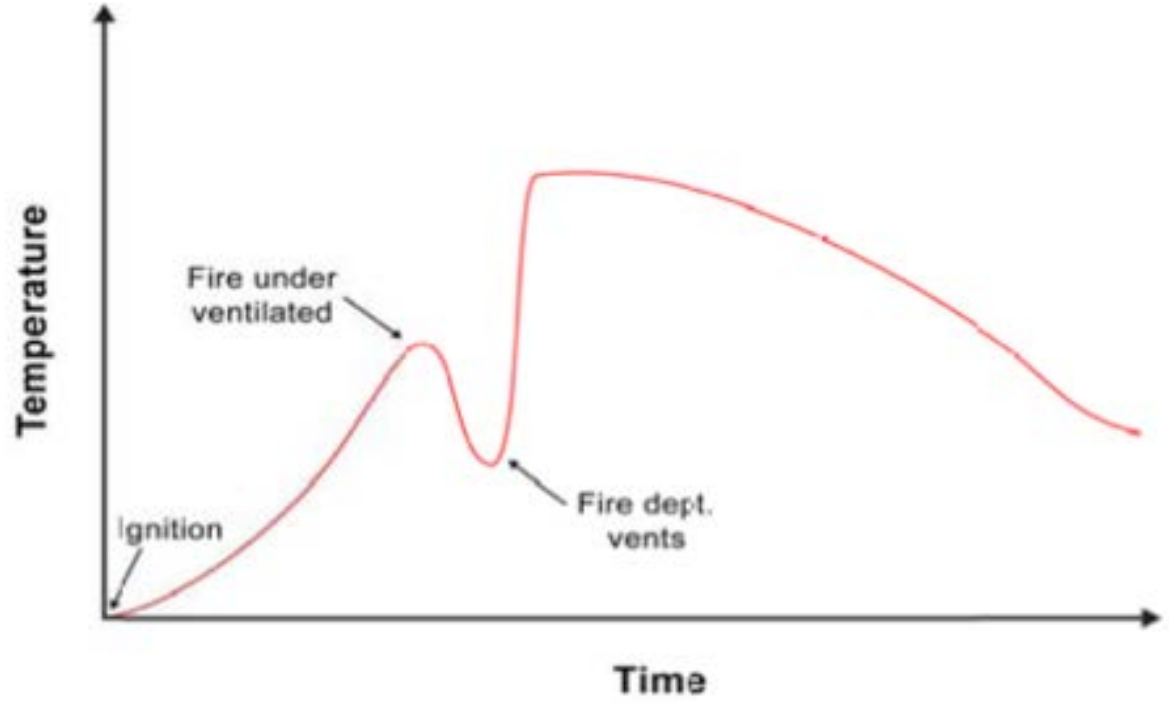
Figure 22: Example of Traditional Time Temperature Curve



[5] Example of Traditional Time Temperature Curve. Retrieved at http://www.usfa.fema.gov/downloads/pdf/coffee-break/time-vs-products-of-combustion.pdf

Recent studies by Underwriter's Laboratories (UL) have found that in compartment fires such as structure fires, flashover occurs within 4 minutes in modern fire environment. In addition, the UL research has identified an updated time temperature curve due to fires being ventilation controlled rather than fuel controlled as represented in the traditional time temperature curve. While this ventilation controlled environment continues to provide a high risk to unprotected occupants to smoke and high heat, it does provide some advantage to property conservation efforts as water may be applied to the fire prior to ventilation and the subsequent flashover. An example of UL's ventilation controlled time temperature curve is provided as Figure 23 below.[6]

Figure 23: Ventilation Controlled Time Temperature Curve



EMS

The effective response to Emergency Medical Service (EMS) incidents also has a direct correlation to the ability to respond within a specified period of time. However, unlike structure fires, responding to EMS incidents introduces considerable variability in the level of clinical acuity. From this perspective, the association of response time and clinical outcome varies depending on the severity of the injury or the illness. Research has demonstrated that the overwhelming majority of requests for EMS services are not time sensitive between 5 minutes and 11 minutes for emergency and 13

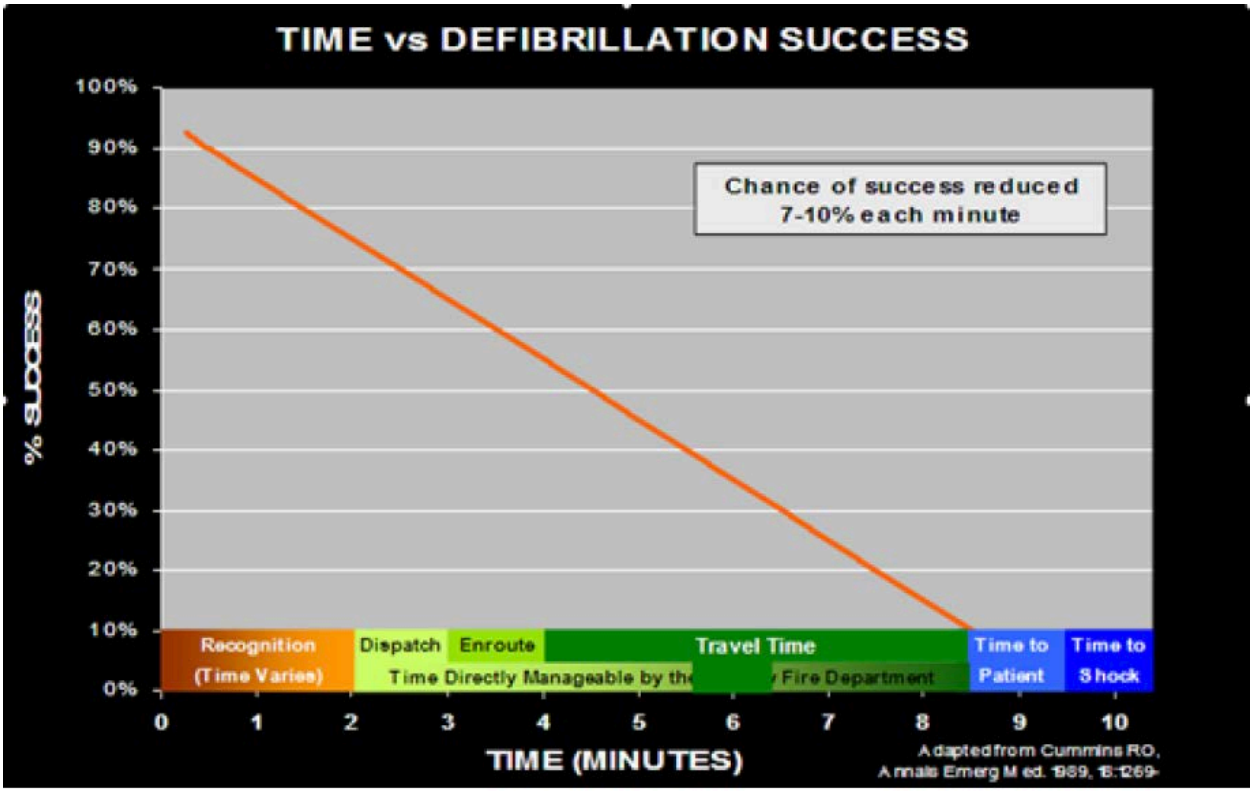
[6] UL/NIST Ventilation Controlled Time Temperature Curve. Retrieved from http://www.nist.gov/fire/fire_behavior.cfm

minutes for non-emergency responses.[7] The 12-minute upper threshold is only the upper limit of the available research and is not a clinically significant time measure, as patients were not found to have a significantly different clinical outcome when the 12-minute threshold was exceeded.[8]

Out of hospital sudden cardiac arrest is the most identifiable and measured incident type for EMS. In an effort to demonstrate the relationship between response time and clinical outcome, a representation of the cascade of events and the time to defibrillation (shock) is presented as Figure 24 below. The American Heart Association (AHA) has determined that brain damage will begin to occur between four and six minutes and become irreversible after 10 minutes without intervention.

Modern sudden cardiac arrest protocols recognize that high quality Cardio-Pulmonary Resuscitation (CPR) at the Basic Life Support (BLS) level is a quality intervention until defibrillation can be delivered in shockable rhythms. Figure 24[9] below is representative of a sudden cardiac arrest that is presenting in a shockable heart rhythm such as Ventricular Fibrillation or Ventricular Tachycardia.

Figure 24: Cascade of Events for Sudden Cardiac Arrest with Shockable Rhythm



[7] Blackwell, T.H., & Kaufman, J.S. (April 2002). Response time effectiveness: Comparison of response time and survival in an urban emergency medical services system. *Academic Emergency Medicine,* 9(4): 289-295.
[8] Blackwell, T.H., et al. (Oct-Dec 2009). Lack of association between prehospital response times and patient outcomes. *Prehospital Emergency Care,* 13(4): 444-450.
[9] Olathe Fire Department. (2012). Adapted from Community Risk and Emergency Services Analysis: Standard of Cover. Olathe, Kansas: Author.

DESCRIPTION OF FIRST ARRIVING UNIT PERFORMANCE

Analyses of the response characteristics of the first arriving units were conducted. This analysis focused on lights and sirens responses. Overall CFD had a mean dispatch time of 42 seconds, and 82 seconds or 1 minute 22 seconds) at the 90th percentile. CFD has a mean turnout time of 66 seconds, and 118 seconds, or one minute and 58 seconds at the 90th percentile.

The travel time for all first arriving unit responses were calculated irrespective of their assigned station FDZ. In other words, this analysis describes the first arriving unit to the scene. The mean travel time was 204 seconds, or three minutes and 24 seconds. Performance at the 90th percentile was 316 seconds, or five minutes and 16 seconds.

As previously discussed, since CAD calls do not capture the complete dispatch interval, the "total response time" is defined as from call entry through unit arriving on scene. The mean response time is 312 seconds, or five minutes and 12 seconds. Performance at the 90th percentile is 440 seconds, or seven minutes and 20 seconds. Results of first arriving unit performance are provided in Table 21 below.

Table 21: Description of First Arriving Unit Emergency Response Performance

Measure	Average	90th Percentile
Dispatch Time	0.7	1.4
Turnout Time	1.1	2.0
Travel Time	3.4	5.3
Turnout and Travel	4.4	6.6
Response Time	5.2	7.3

First Arriving Unit Response Time by Station Demand Zone

Further analyses were conducted to measure the performance of the first arriving unit in each demand zone. Response times are reported below at both the mean and 90th percentile as Tables 22 and 23, respectively.

Examination of the overall performance at the 90th percentile reveals that Station 1 had the quickest response times followed by Stations 2, 4, 5, 6 and 3 in order of performance. The FDZ with the longest total response times is station 3. An illustrative comparison of FDZ performance at the 90th percentile is provided below.

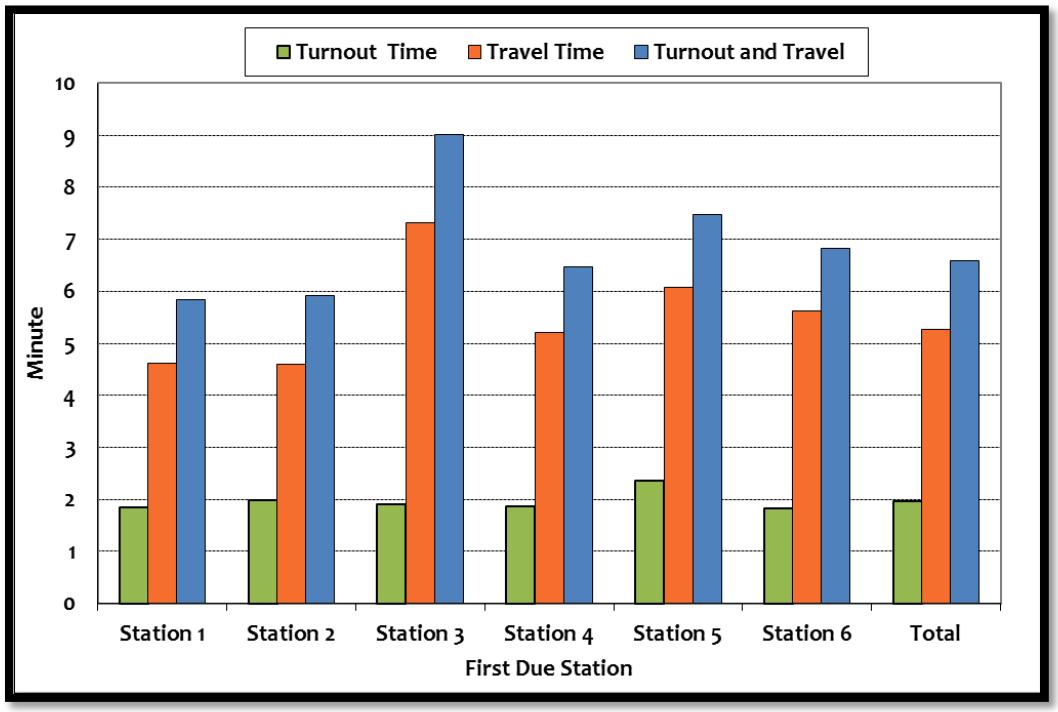
Table 22: Mean First Arrival Performance by First Due Station

First Due Station	Dispatch Time	Turnout Time	Travel Time	Turnout and Travel	Response Time	Sample Size
Station 1	0.8	1.0	2.8	3.8	4.6	1,998
Station 2	0.7	1.1	3.1	4.2	4.9	2,467
Station 3	1.1	1.0	5.1	6.1	7.2	118
Station 4	0.7	1.0	3.4	4.4	5.1	1,074
Station 5	0.7	1.3	4.1	5.4	6.1	1,140
Station 6	0.6	1.1	3.9	5.0	5.6	1,042
Total	**0.7**	**1.1**	**3.4**	**4.4**	**5.2**	**7,839**

Table 23: 90th Percentile First Arrival Performance by Station FDZ

First Due Station	Dispatch Time	Turnout Time	Travel Time	Turnout and Travel	Response Time	Sample Size
Station 1	1.6	1.9	4.6	5.8	6.6	1,998
Station 2	1.4	2.0	4.6	5.9	6.8	2,467
Station 3	2.6	1.9	7.3	9.0	11.1	118
Station 4	1.3	1.9	5.2	6.5	7.3	1,074
Station 5	1.2	2.4	6.1	7.5	8.3	1,140
Station 6	1.2	1.8	5.6	6.8	7.5	1,042
Total	**1.4**	**2.0**	**5.3**	**6.6**	**7.3**	**7,839**

Figure 25: 90th Percentile First Arrival Performance by Station FDZ



The data were further analyzed to compare the individual station FDZ performances. With respect to turnout time, Station 1 had the shortest turnout time at 111 seconds or one minute and 51 seconds. Station 5 calls had the longest turnout time at 141 seconds or two minutes and 21 seconds. Conversely, when examining the travel time performance, performances for calls in station 3 and 5 were significantly longer than calls in other first due stations. Similarly, since travel time is the single largest indicator of overall response performance, the turnout plus travel time analysis revealed that 90th percentile measurements for calls in first due stations 3 and 5 were significantly longer than calls in the other stations.

Figure 26: 90th Percentile Turnout Time by Station FDZ

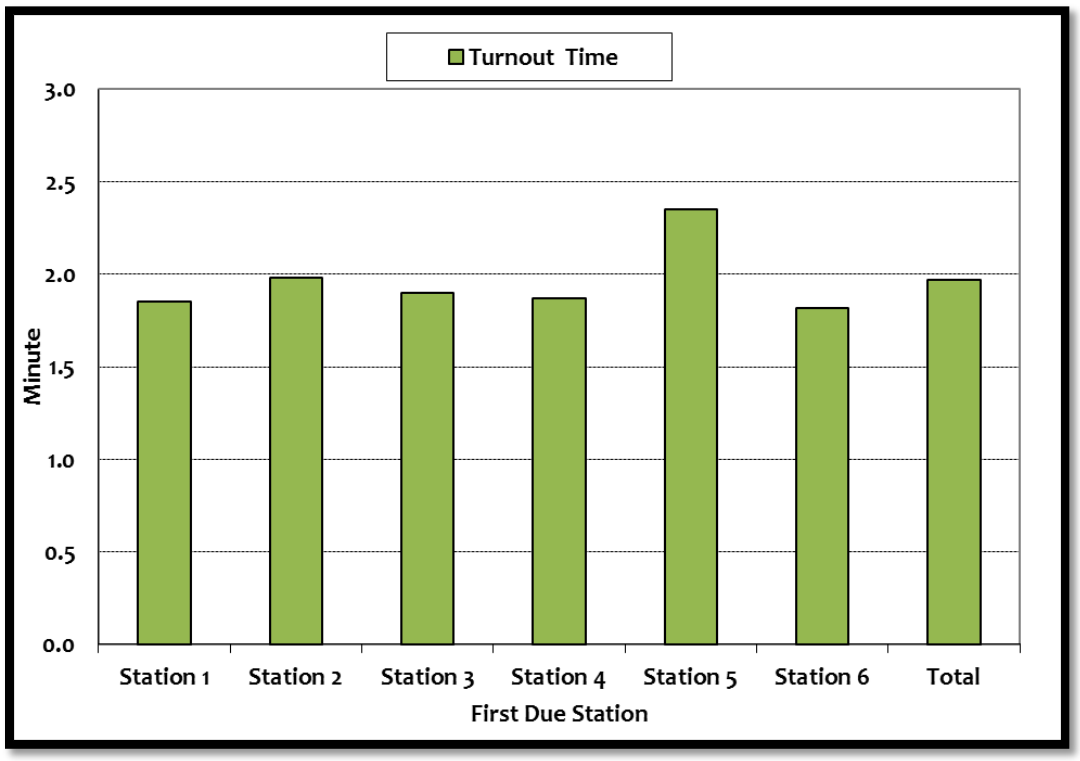


Figure 27: 90th Percentile Travel Time Performance by Station FDZ

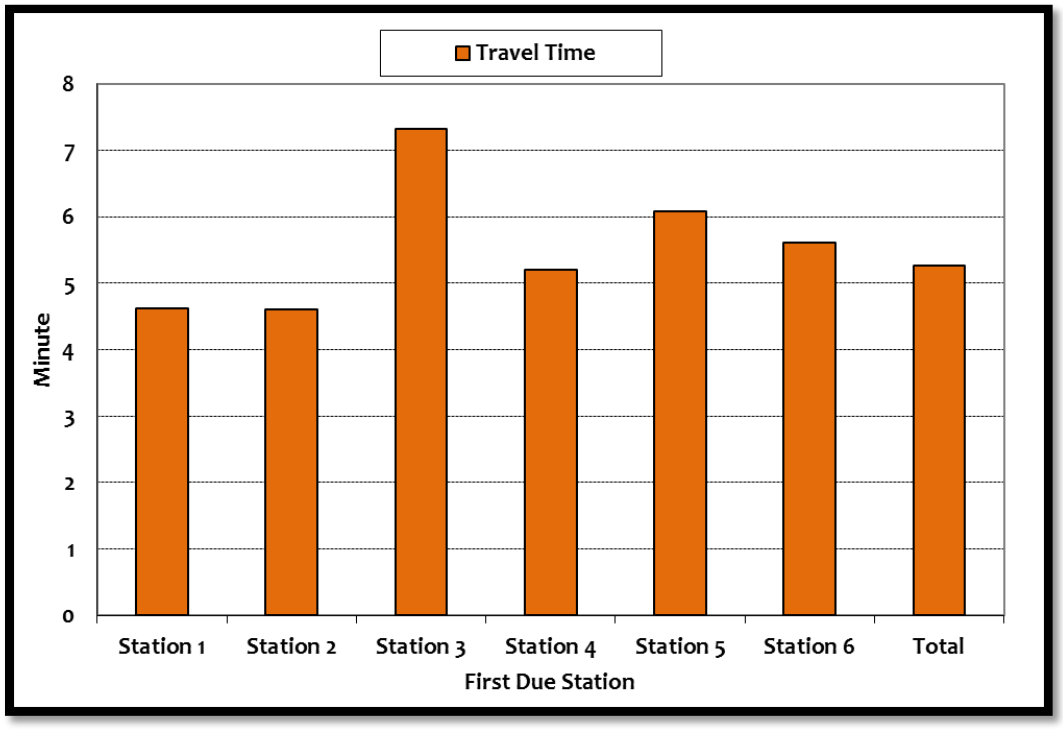


Figure 28: 90th Percentile Turnout and Travel Performance by Station FDZ

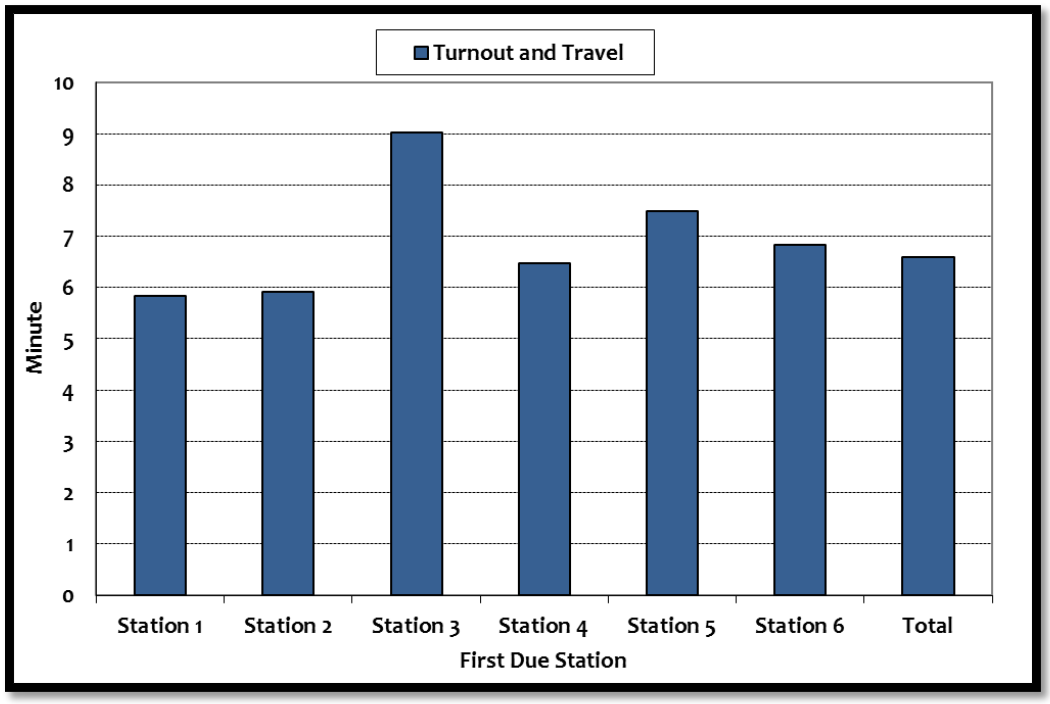
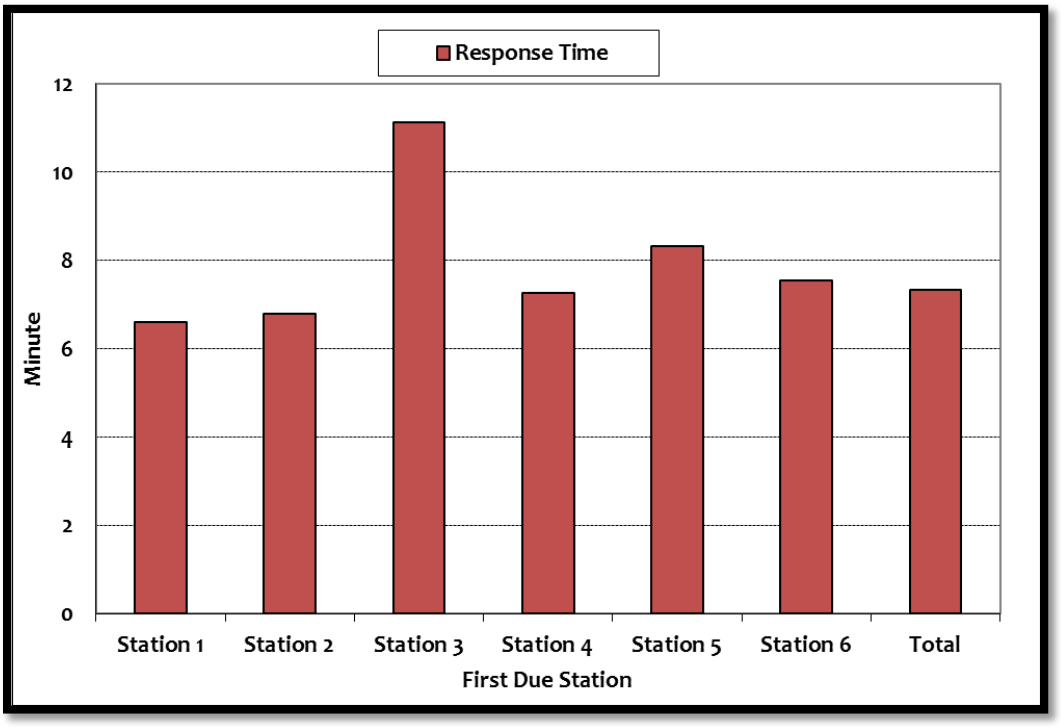


Figure 29: 90th Percentile Response Time Performance by Station FDZ



Effective Response Force Capabilities

The capability of an Effective Response Force (ERF) to assemble in a timely manner with the appropriate personnel, apparatus, and equipment is important to the success of a significant structural fire event. Therefore, it is important to measure the capabilities of assembling an ERF. In most fire departments, the distribution model performs satisfactorily, but it is not uncommon to be challenged to assemble an ERF in the recommended timeframes.

Several factors affect the capabilities to assemble an ERF such as the number of fire stations, number of units, and number of personnel on each unit. Each of these policy decisions should be made in relation to community's specific risks and the willingness to assume risk. Analyses of historical performance for each station reveal that station demand zones of 1 and 2 meet or exceed best practice recommendations of eight minutes on average. The second arriving units of station demand zones 1, 2, 3, and 6 had average travel time less than or equal to eight minutes[10] [11]. However, please note that 90% of the incidents used in response time analysis had only one CFD unit responding, so the sample size for 2nd, 3rd and 4th arriving units reduced dramatically.

[10] National Fire Protection Association. (2010). NFPA 1710, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments*. Boston, MA: National Fire Protection Association.
[11] CFAI. (2009). Fire & emergency service self-assessment manual, (8th ed.). Chantilly, Virginia: Author. (page 71)

Table 24: Sample Size for ERF Travel Performance Analysis

First Due Station	Sample Size Order of Arrival 1	2	3	4
Station 1	1,998	67	30	17
Station 2	2,467	85	49	29
Station 3	118	3	1	1
Station 4	1,074	33	12	8
Station 5	1,140	34	23	12
Station 6	1,042	32	17	8

Table 25: Historical Average Travel Time Performance for ERF by Station FDZ

First Due Station	Order of Arrival 1	2	3	4
Station 1	2.8	3.6	4.7	5.7
Station 2	3.1	4.1	5.1	5.8
Station 3	5.1	4.7	7.2	9.0
Station 4	3.4	5.8	5.7	6.2
Station 5	4.1	5.7	8.5	7.8
Station 6	3.9	4.3	5.4	5.6

Figure 30: Mean ERF Travel Performance for Station 1

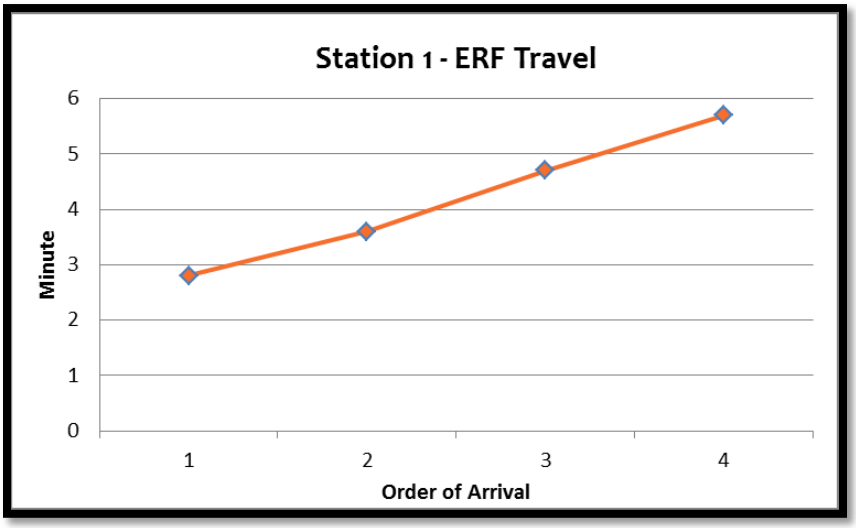


Figure 31: Mean ERF Travel Performance for Station 2

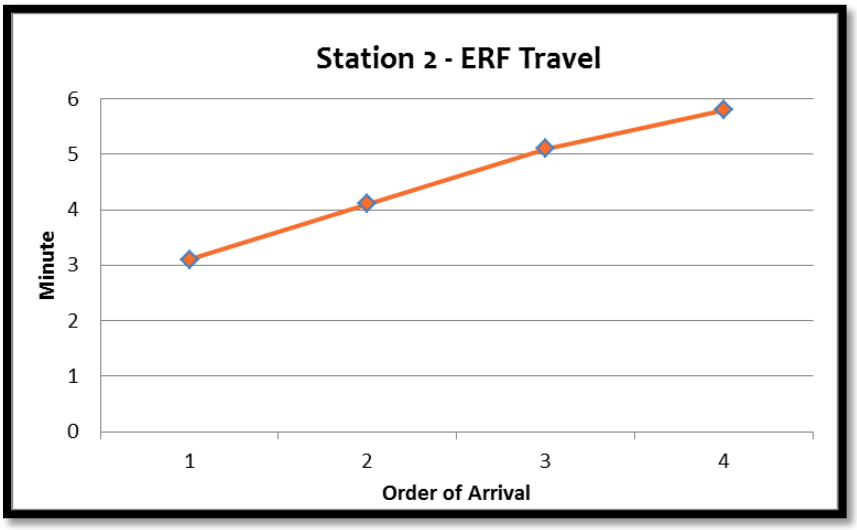


Figure 32: Mean ERF Travel Performance for Station 3

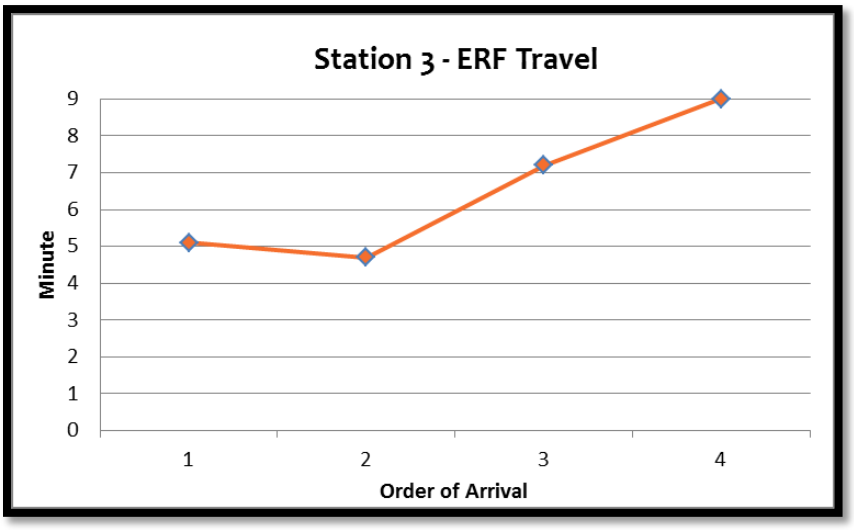


Figure 33: Mean ERF Travel Performance for Station 4

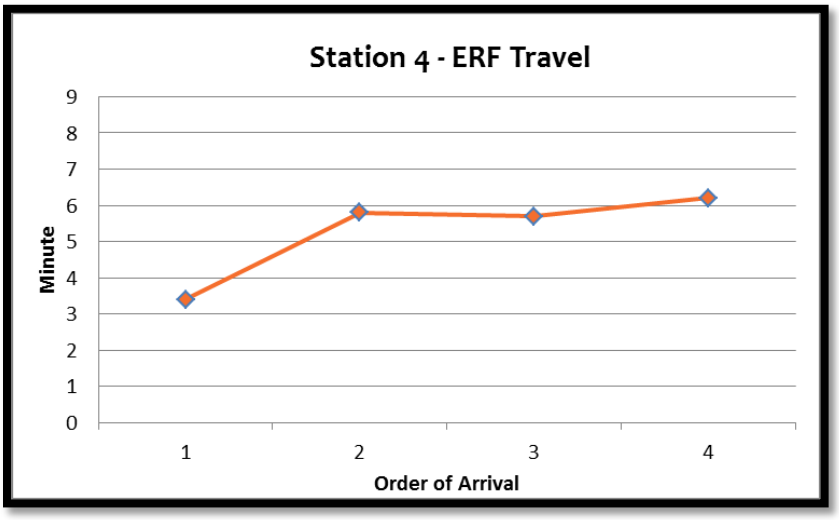


Figure 34: Mean ERF Travel Performance for Station 5

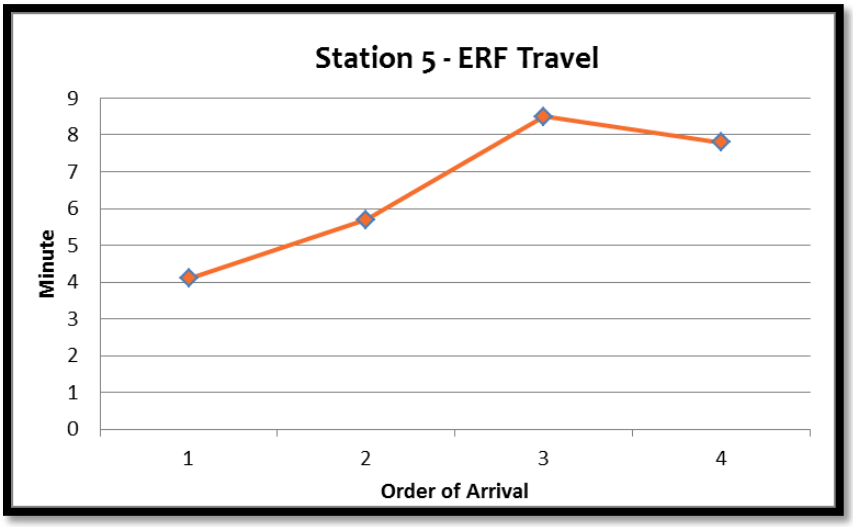


Figure 35: Mean ERF Travel Performance for Station 6

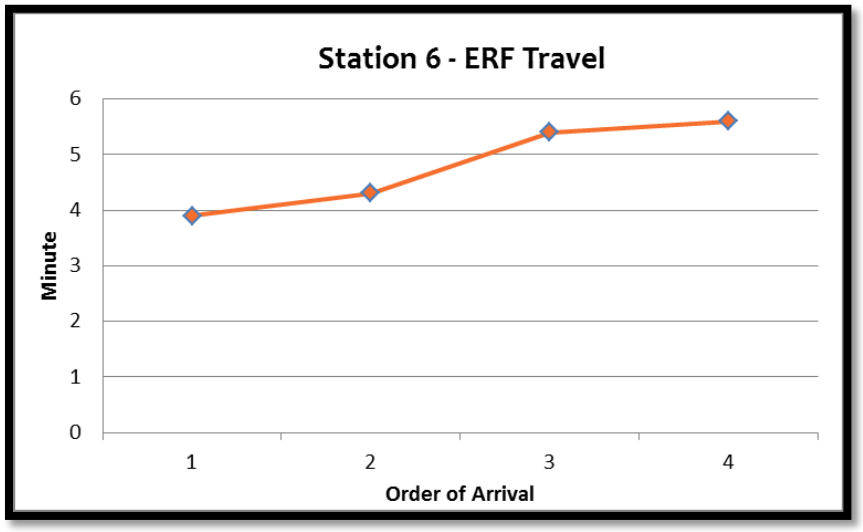


Table 26: Historical 90th Percentile Travel Time Performance for ERF by Station FDZ

First Due Station	Order of Arrival 1	2	3	4
Station 1	4.6	5.6	5.5	7.6
Station 2	4.6	5.6	6.5	7.7
Station 3	7.3	5.5	7.2	9.0
Station 4	5.2	8.5	6.9	9.9
Station 5	6.1	9.8	15.9	8.6
Station 6	5.6	6.3	9.4	9.6

Figure 36: 90th Percentile ERF Travel Performance for Station 1

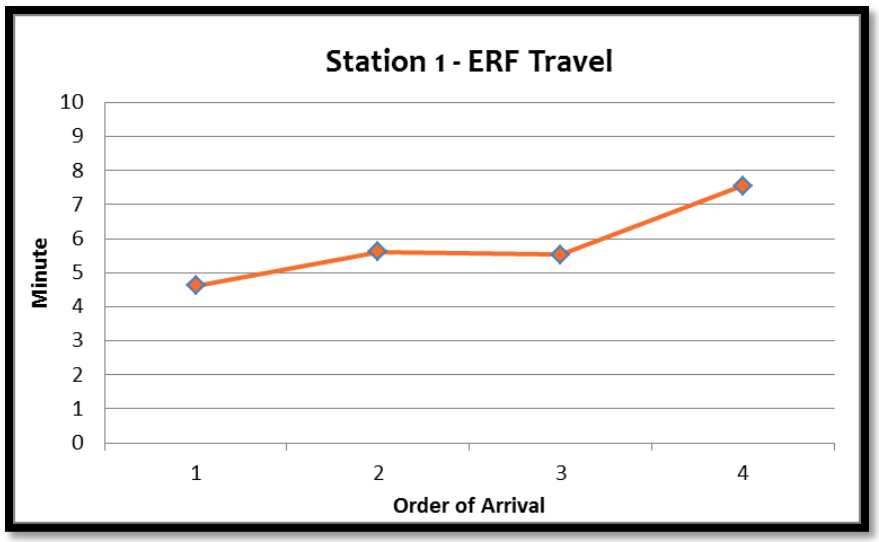


Figure 37: 90th Percentile ERF Travel Performance for Station 2

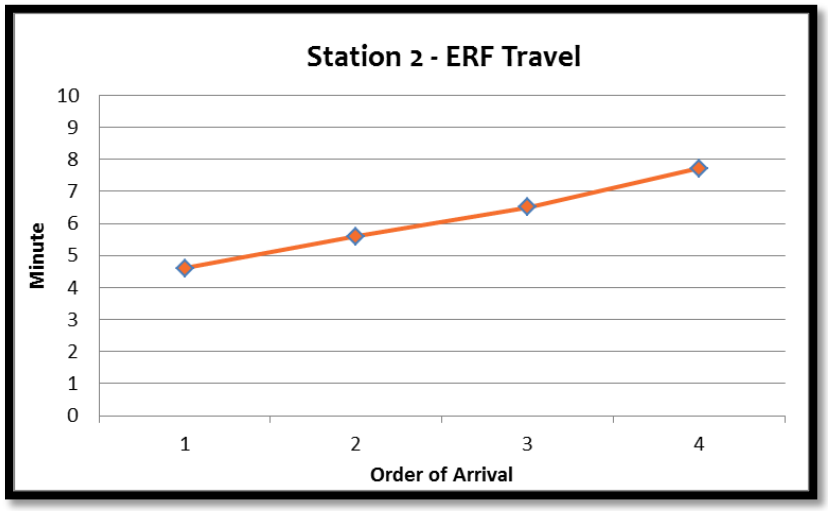


Figure 38: 90th Percentile ERF Travel Performance for Station 3

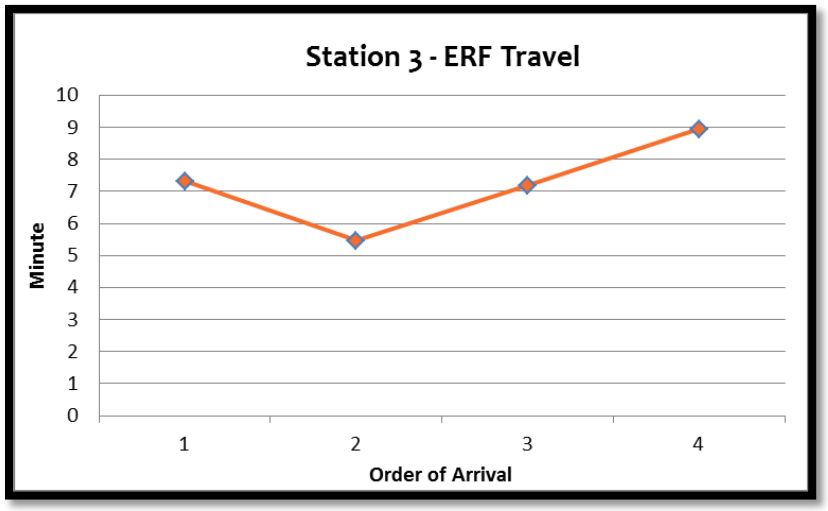


Figure 39: 90th Percentile ERF Travel Performance for Station 4

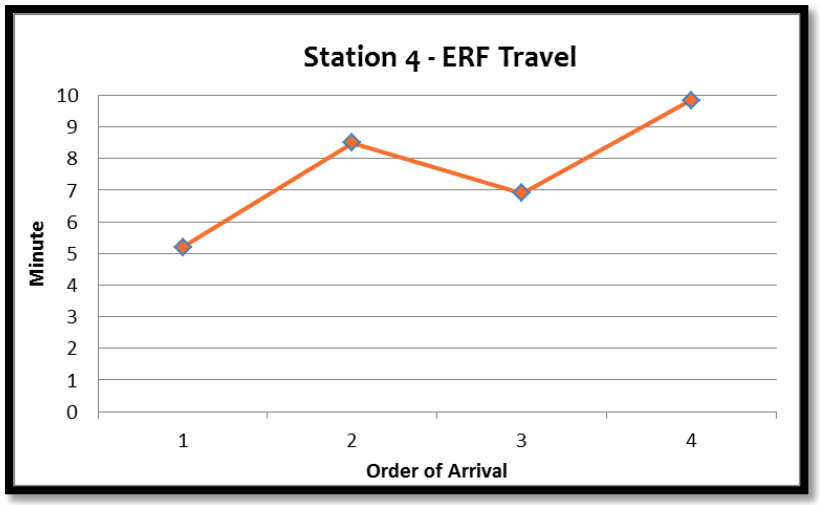


Figure 40: 90th Percentile ERF Travel Performance for Station 5

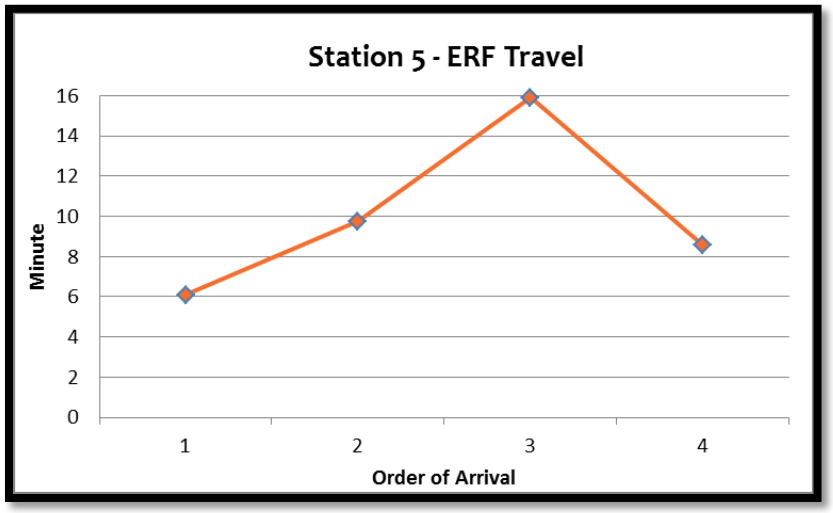
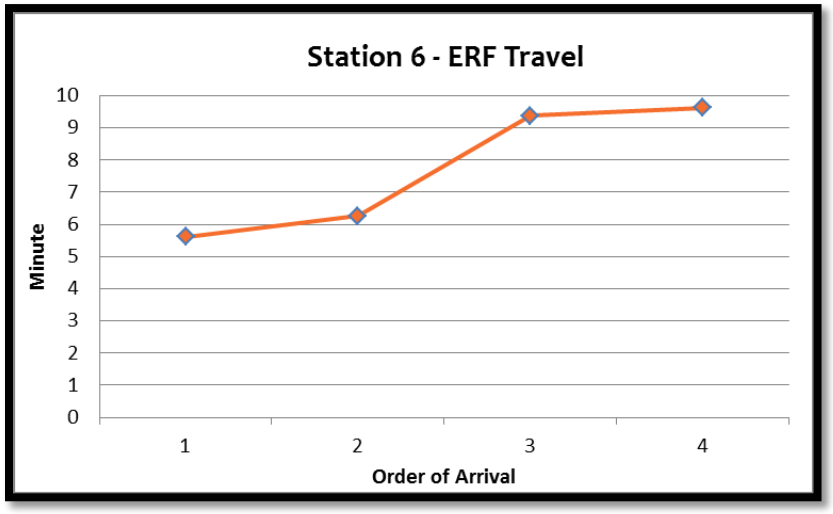


Figure 41: 90th Percentile ERF Travel Performance for Station 6



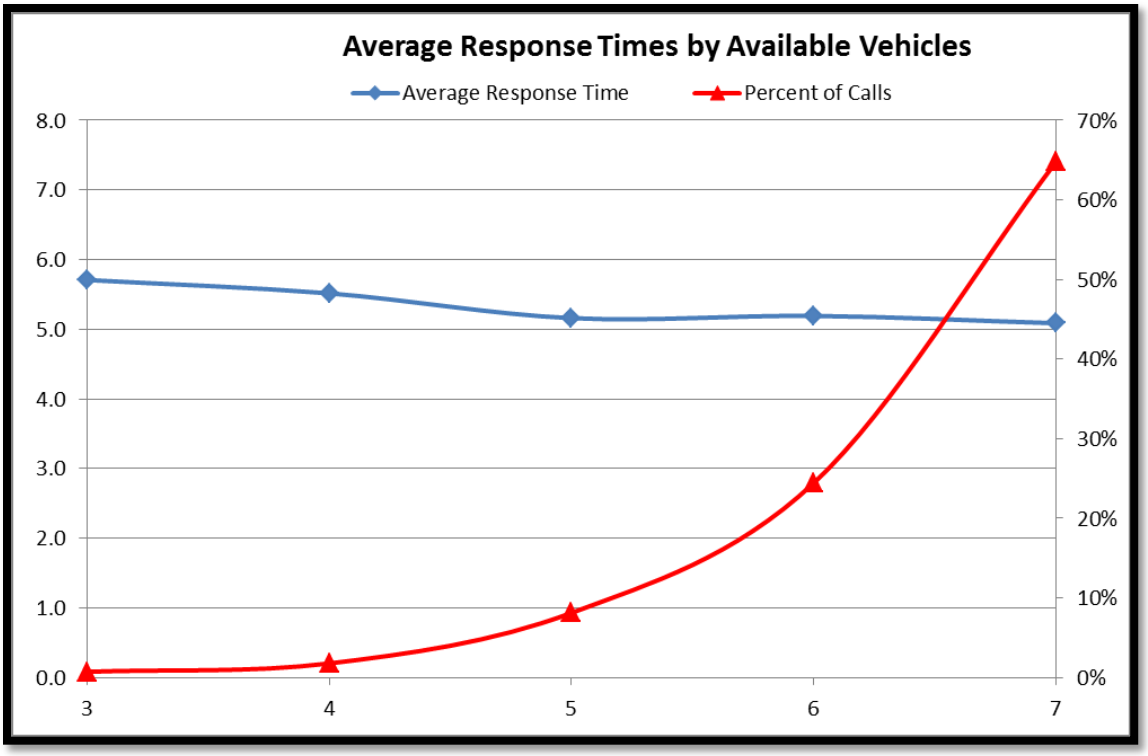
Response Time performance by Available Vehicles

We also investigate whether the response time performance deteriorated when there were fewer vehicles available using three years of data. In this analysis, admin and utility vehicles were excluded. We assume the department has constantly staffed seven units (SQ1 and T1 in station 1, E2 or R2 in station 2, E3 or CR3 in station 3 (cross staffed with one firefighter), E4 in station 4, E5 in station 5, and E6 in station 6). For 89% of the time, CFD had 6 or 7 units available to be dispatched. There was less than 1% of the time when CFD had 3 or less units available. Since the distribution of response time had larger variance due to small sample size for 3 or less units available, we conclude that the department does not have a limited resource constraint in terms of average response time performance.

Table 27: Average Response Time by Available Vehicles

No. of Available Vehicles	Average Dispatch Time	Turnout Time	Travel Time	Response Time	Sample Size	Percent of Calls
7	0.6	1.2	3.3	5.1	15,924	64.8%
6	0.7	1.1	3.4	5.2	6,005	24.4%
5	0.7	1.1	3.3	5.2	1,995	8.1%
4	0.9	1.1	3.6	5.5	433	1.8%
3	1.0	1.0	3.8	5.7	175	0.7%
2	1.4	0.8	4.4	6.7	47	0.2%
1	1.0	0.9	3.3	5.2	9	0.0%
0	0.6	1.5	4.8	6.9	1	0.0%

Figure 42: Average Response Time by Available Vehicles



Reliability Factors

Percentage of Department Compliance

The first step in assessing the reliability of the deployment model or system performance is to understand the department's availability to handle the requests for service that occur within the department's jurisdiction. Chico Fire Department responds to a total of 493 non-canceled calls in the county. County units E41, E42 and E44 stationed in county stations 41, 42 and 44 and other county

units have responded to a total of 2,948 calls in Chico, among which 2,711 (92%) calls had no Chico unit responding. Chico Fire Department is available to respond to 78% of the requests for service that are originating within the jurisdiction. We broke down the 493 mutual aid calls into more granular call categories using the CAD descriptions. A total of 33 were structure, outside or vehicle fires. On average, county units responded to 8.1 calls per day in Chico, and 79% of those calls were EMS related requests, and 102 were structure, outside or vehicle fires.

Table 28: Mutual Aid Interaction between Chico and County Units

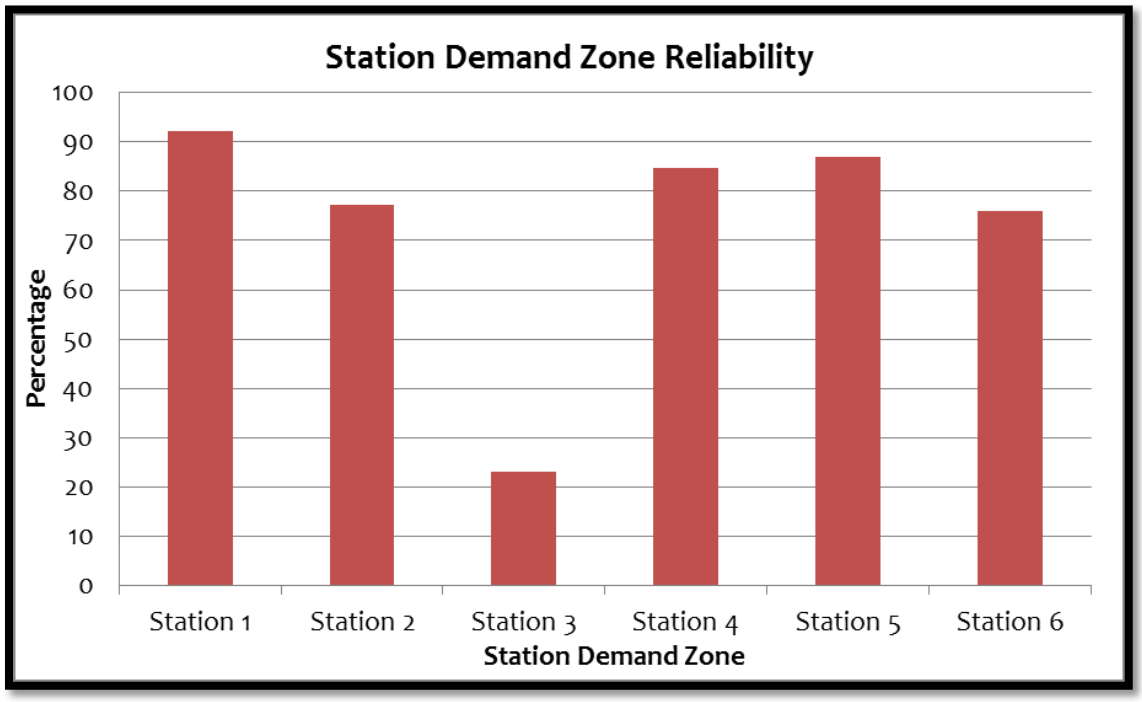
Scenario	Chico Units Responding to County Calls	County Units Responding to Chico Calls		
Call Category	Number of Calls	Number of Calls (No Chico Unit)	Number of Calls (Together with Chico Units)	Total
Cardiac and stroke	22	218	4	222
Seizure and unconsciousness	13	262	3	265
Breathing difficulty	21	259	7	266
Overdose and psychiatric	3	64	1	65
MVA	38	127	45	172
Fall and injury	30	365	3	368
Illness and other	236	958	10	968
EMS Total	**363**	**2,253**	**73**	**2,326**
Structure fire	18	5	49	54
Outside fire	11	8	23	31
Vehicle fire	4	9	8	17
False alarm	7	131	15	146
Good intent	0	21	9	30
Public service	33	234	5	239
Fire other	42	41	31	72
Fire Total	**115**	**449**	**140**	**589**
Rescue	**3**	**1**	**1**	**2**
Hazmat	**12**	**8**	**23**	**31**
Total	**493**	**2,711**	**237**	**2,948**

Percentage of First Due Compliance

The reliability of the distribution model is a factor of how often the response model is available and able to respond to the call within the assigned demand zone. If at least one unit from the first due station is able to respond to a call, we consider the station is able to response to the call within the assigned demand zone. Utilizing the Fire Station Demand Zones (FDZ), analyses reveal that station 1 was capable of meeting their demand for services at the 90th percentile. In other words, when a request for service is received all stations are available to answer the call nine out of 10 times. Station

3 had the lowest reliability of 23%. Station 1 had the highest reliability at 92.3 percent. This analysis utilized all dispatched calls within the jurisdiction and the performance included all assigned units to the specific FDZ.

Figure 43: Percentage Reliability by Station FDZ



Overlapped or Simultaneous Call Analysis

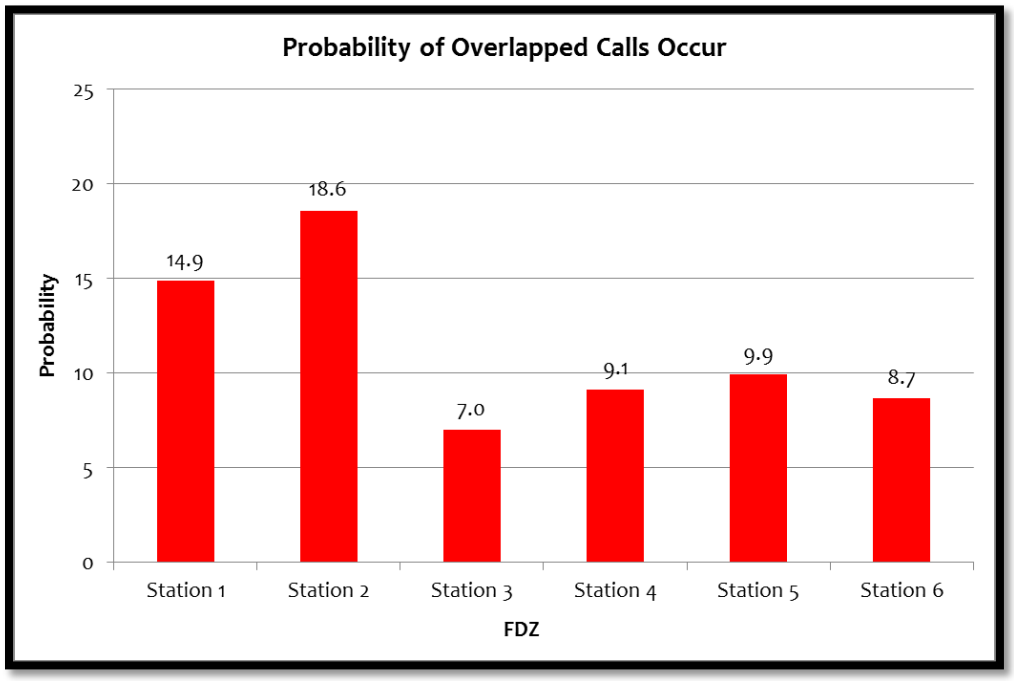
Overlapped calls are defined as the rate at which another call was received for the same first due station while there were one or more ongoing calls in the same first due station. For example, if there is one call in station 1's zone, before the call was cleared another request in station 1's zone occurred and those two calls would be captured as overlapped calls. Some studies also refer as simultaneous calls. Understanding the probability of overlapped or simultaneous calls occurs will help to determine the number of units to staff for each station. In general, the larger the call volume a first due station has, it is more likely to have overlapped or simultaneous calls. The distribution of the demand throughout the day will impact the chance of having overlapped or simultaneous calls. The duration of a call will also have major influences, since the longer time it takes to clear a request, the more likely to have an overlapped request.

CFD Station 2 has the highest probability of having overlapped calls at 18.6% since it has the most number of calls of all six demand zones, followed by station 1 at 14.9%, and the other four stations had the probability of overlapped calls occur less than 10% chance.

Table 29: Overlapped Calls by First Due Station

First Due Station	Overlapped Calls	Total Calls	Probability of Overlapped Calls Occur
Station 1	372	2,501	14.9
Station 2	573	3,082	18.6
Station 3	14	200	7.0
Station 4	118	1,290	9.1
Station 5	144	1,450	9.9
Station 6	107	1,234	8.7

Figure 44: Probability of Overlapped Calls Occur by Station FDZ



BASELINE PERFORMANCE TABLES

From 2013 to 2015, the total number of calls was from 10,373 to 10,738 or the average number of calls CFD has responded to range from 28.4 to 29.4. The total unit responses were from 12,692 (in 2014) to 13,409 (in 2015), or 34.8 unit responses per day to 36.7 unit response per day. Tables 30 and 31 present the overall demand and CFD's workload.

Table 30: Number of Incidents Dispatched by Category and Year

Call Category	Number of Calls 2013	2014	2015
Cardiac and stroke	722	635	590
Seizure and unconsciousness	729	833	894
Breathing difficulty	712	645	653
Overdose and psychiatric	370	401	376
MVA	509	545	601
Fall and injury	870	986	1,032
Illness and other	2,397	2,596	2,678
EMS Total	**6,309**	**6,641**	**6,824**
Structure fire	77	78	92
Outside fire	252	291	268
Vehicle fire	25	21	26
False alarm	528	502	436
Good intent	78	114	98
Public service	686	634	727
Fire other	336	273	312
Fire Total	**1,982**	**1,913**	**1,959**
Rescue	20	18	11
Hazmat	65	88	86
Mutual aid	571	541	493
Canceled	1,426	1,270	1,365
Total	**10,373**	**10,471**	**10,738**
Calls per Day	**28.4**	**28.7**	**29.4**

Table 31: Number of Calls, Number of Responses, and Total Busy Time by Year

Year	Number of Calls	Number of Responses	Average Responses per Call	Total Busy Hours	Average Busy Minutes per Response
2013	10,373	12,983	1.3	3,896	18.0
2014	10,471	12,692	1.2	3,234	15.3
2015	10,738	13,409	1.2	3,669	16.4

Tables 32-35 represent the baseline response performance for EMS and fire incidents. We do not report rescue and hazmat incidents due to their small sample sizes. Since 91% of the EMS incidents only had one dispatched CFD unit, we only report the first arriving unit for EMS incidents. For fire category calls, 17% incidents had second arriving unit, thus we report the performances of 2nd arriving units as ERF for the fire category calls.

For EMS calls, in the past three years, the average dispatch time was 36 seconds or 0.6 minutes. The average turnout and travel time was 264 seconds or four minutes and 24 seconds, and the average response time was 300 seconds or five minutes. For fire category calls, in the past three years, the average dispatch time was 48 seconds. The average turnout and travel time of the first arriving unit was 300 seconds and the average response time was 342 seconds. The average turnout and travel time of the ERF unit or second arriving unit was 378 seconds, which is 78 seconds longer than the first arriving unit. The average response time of the ERF unit or second arriving unit was 438 seconds, which is 96 seconds longer than the first arriving unit.

Table 32: Baseline Performance for EMS Incidents -2013/2015

EMS (Lights and Sirens) Average Time - 1st Arriving Unit		2013 - 2015	2015	2014	2013
Alarm Handling	Call Entry to Dispatch	0.6	0.7	0.7	0.4
Turnout Time	Turnout Time	1.1	1.0	1.0	1.4
Travel Time	Travel Time	3.3	3.3	3.3	3.2
Turnout and Travel Time	Turnout and Travel Time	4.4	4.3	4.3	4.5
Response Time	Call Entry to Onscene	5.0	5.0	5.0	5.0
Sample Size	1st Arriving Unit	19,012	6,592	6,315	6,105

Table 33: Baseline Performance for Fire Incidents -2013/2015

Fire (Lights and Sirens) Average Time		2013 - 2015	2015	2014	2013
Alarm Handling	Call Entry to Dispatch	0.8	0.9	0.8	0.6
Turnout Time	Turnout Time - 1st Unit	1.4	1.2	1.2	1.7
Travel Time	Travel Time - 1st Unit	3.6	3.7	3.7	3.4
	Travel Time - ERF (2nd Unit)	4.6	4.1	5.0	4.5
Turnout and Travel Time	Turnout and Travel Time - 1st Unit	5.0	5.0	4.9	5.0
	Turnout and Travel Time - ERF (2nd Unit)	6.3	5.6	6.5	6.6
Response Time	Call Entry to Onscene - 1st Unit	5.7	5.8	5.8	5.6
	Call Entry to Onscene - ERF (2nd Unit)	7.3	6.8	7.7	7.3
Sample Size	1st Unit	3,714	1,171	1,242	1,301
	ERF (2nd Unit)	595	156	153	286

We also summarized 90th percentile performances for the 1st arriving and ERF units for EMS and fire incidents separately. For EMS calls, in the past three years, the 90 percentile dispatch time was 72 seconds. The 90th percentile turnout and travel time was 385 seconds (6 minutes and 25 seconds). The 90th percentile response time was 424 seconds (7 minutes and 4 seconds). Please note that the 90th percentile response time is not the same as adding 90th percentile dispatch time and 90th percentile turnout and travel time.

For fire suppression calls, in the past three years, the 90th percentile dispatch time was 92 seconds (1 minute and 2 seconds). The 90th percentile turnout and travel time of the first arriving unit was 434 seconds (7 minutes and 14 seconds). The 90th percentile response time of the first arriving unit was 488 seconds (8 minutes and 8 seconds). The 90th percentile turnout and travel time of the ERF unit or second arriving unit was 510 seconds (8 minutes and 30 seconds), which was 76 seconds longer than the first arriving unit. The 90th percentile response time of the ERF unit or second arriving unit was 563 seconds (9 minutes and 23 seconds), which was 75 seconds longer than the first arriving unit.

The department can reference the historical performances and make reasonable targets to continuously improve the response process to meet recommended targets by industry standards or best practices

Table 34: Summary of 90th Percentile Performance for EMS (BLS/ALS) Incidents – 2013/2015

EMS (Lights and Sirens) 90th Percentile Time - 1st Arriving Unit		2013 - 2015	2015	2014	2013
Alarm Handling	Call Entry to Dispatch	1.2	1.3	1.3	0.9
Turnout Time	Turnout Time	2.0	1.9	1.8	2.2
Travel Time	Travel Time	5.1	5.1	5.2	4.9
Turnout and Travel Time	Turnout and Travel Time	6.4	6.4	6.4	6.5
Response Time	Call Entry to Onscene	7.1	7.2	7.1	6.9
Sample Size	1st Unit	19,012	6,592	6,315	6,105

Table 35: Summary of 90th Percentile Performance for Fire Incidents – 2013/2015

Fire (Lights and Sirens) 90th Percentile Time		2013 - 2015	2015	2014	2013
Alarm Handling	Call Entry to Dispatch	1.5	1.7	1.6	1.3
Turnout Time	Turnout Time - 1st Unit	2.3	2.2	2.0	2.6
Travel Time	Travel Time - 1st Unit	5.8	6.0	5.8	5.4
	Travel Time - ERF (2nd Arriving Unit)	6.6	6.0	7.3	6.7
Turnout and Travel Time	Turnout and Travel Time - 1st Unit	7.2	7.4	7.1	7.2
	Turnout and Travel Time - ERF (2nd Unit)	8.5	7.7	8.8	8.6
Response Time	Call Entry to Onscene - 1st Unit	8.1	8.4	8.1	7.9
	Call Entry to Onscene - ERF (2nd Unit)	9.4	8.7	10.0	9.4
Sample Size	1st Unit	3,714	1,171	1,242	1,301
	ERF (2nd Unit)	595	156	153	286

Attachment B

GIS Report

FITCH
& ASSOCIATES

December 2016

Standard of Cover Study

GIS Analysis

Chico Fire Department
Chico, California

Prepared by:

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CONSULTANT REPORT

Standard of Cover Study
Draft GIS Analysis
Chico Fire Department

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ESTABLISHING BASELINE PERFORMANCE

The first step in completing GIS planning analyses is to establish the desired performance parameters. Measures of total response time can be significantly influenced by both internal and external influences. For example, the dispatch time, defined as the time from pick up at the 911 center to the dispatching of units, contributes to the customer's overall response time experience but may be outside of the fire department's direct control. Another element in the total response time continuum is the turnout time, defined as the time from when the units are notified of the incident until they are actually responding. Turnout time can have a significant impact to the overall response time for the customer and is generally considered under management's control. However, the travel time, defined as the period from when the units are actually responding until arrival at the incident is a factor of the number of fire stations, the ability to travel unimpeded on the road network, the existing road network's ability to navigate the community, and the availability of the units. Largely, travel time is the most stable variable to utilize in system design regarding response time performance.

Therefore, these GIS planning analyses will focus on travel time capability as the unit of measure. The 2015 performance for travel time across programs is provided as Table 1. Overall, the travel time is 5.3 minutes or less for 90% of the incidents. However, the Fire related incidents had a travel time performance of 6 minutes or less for 90% of the incidents and will be utilized as the upper threshold for comparisons to the current performance.

Table 1: 90th Percentile Turnout and Travel Time of First Arriving Units by Program

Program	Dispatch Time	Turnout Time	Travel Time	Turnout and Travel	Response Time	Sample Size
EMS	1.3	1.9	5.1	6.4	7.2	6,592
Fire	1.7	2.2	6.0	7.4	8.4	1,171
Rescue	1.5	1.5	8.4	9.9	11.1	5
Hazmat	2.8	2.0	5.4	7.1	7.8	74
Total	**1.4**	**2.0**	**5.3**	**6.6**	**7.3**	**7,842**

Comparison to National References

There are two notable references for travel time available to the fire service in National Fire Protection Association (NFPA) 1710[1] and the Commission on Fire Accreditation International (CFAI)[2].

NFPA 1710 suggests a 4-minute travel time at the 90th percentile for first due arrival of Basic Life Support (BLS) and Fire incidents and the CFAI recommends a 5 minute and 21 seconds travel time for

[1] National Fire Protection Association. (2010). NFPA 1710, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments*. Boston, MA: National Fire Protection Association.

[2] CFAI. (2009). Fire & emergency service self-assessment manual, (8th ed.). Chantilly, Virginia: Author. (page 71)

first due arrival in an urban population density. It is important to note that the latest edition (9th edition) of the CFAI guidelines have de-emphasized response time and only reference the legacy standards with a separately provided companion document[3].

The CFAI recommendations are more closely aligned with the department's historical performance. However, the department is not currently capable of meeting the more restrictive recommendation of 4 minutes travel time or less at the 90th percentile. GIS analyses were conducted to determine the requisite distribution model (fire stations) to overcome the geographic limitations within the City of Chico's jurisdiction.

When utilizing only current City of Chico fire stations, the current configuration is capable of delivering a 4-minute travel time to 62% of the requests for service across all call types. This analysis excluded the airport Station 3 as well as the three county fire stations closest to the City. When referring to the marginal utility analysis provided below, the ascending rank order is the station's capability to cover risk (incidents) in relation to the total historical call volume of the sample period (2015). The Station number is the current Chico fire station identifier. The station capture is the number of calls the station would capture within a 4-minute travel time. The total capture is the cumulative number of calls captured with the addition of each fire station. The percent capture is the total cumulative percentage of risk covered by each station. The goal would be to achieve at least 90 percent capture.

Therefore, the station that contributed the most to the overall system's performance was Station 1 in the first column and would capture 29.09% of the risks within four minutes. Station 2 would cover an additional 16.5% of the risk bringing the cumulative total to 45.59% between Stations 1 and 2. In total, with all five Chico fire stations, 62.71% of the incidents could be responded to within four minutes travel time. Results are provided as Table 2 and in drive time mapping format as Figure 1 below.

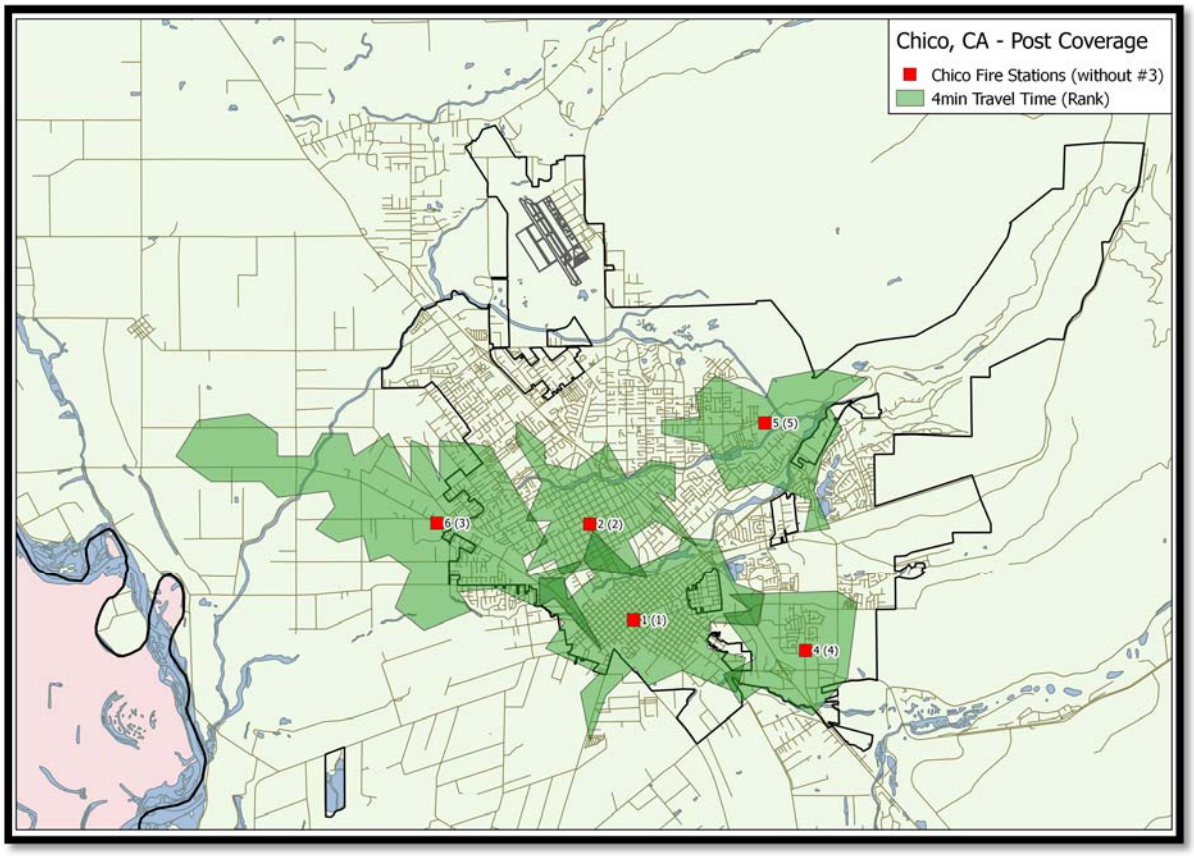
Table 2: Marginal Fire Station Contribution with Chico Fire Stations for 4-Minute Travel Time

Rank	Station Number	Station Capture	Total Capture	Percent Capture
1	1	3512	3512	29.09%
2	2	2113	5625	46.59%
3	6	726	6351	52.60%
4	4	610	6961	57.66%
5	5	545	7506	62.17%

Note: If Station 3 is included it would contribute 0.59% additional coverage.

[3] CFAI. (2016). Fire & emergency service self-assessment manual, (9th ed.). Chantilly, Virginia: Author.

Figure 1: 4-Minute Travel Time Bleed with Chico Stations (excluding Station 3)

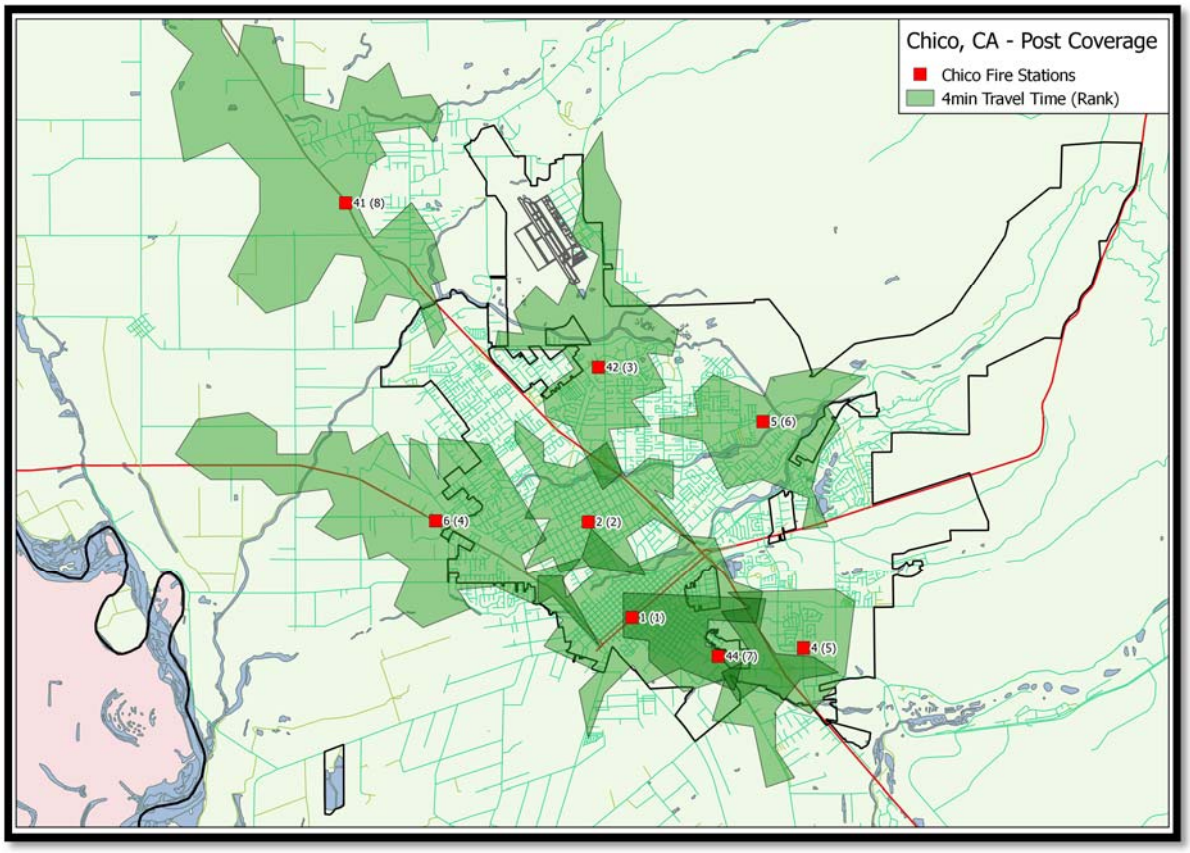


It is understood that the Butte County Fire Department (Cal Fire) provides automatic and mutual aid coverage for the City of Chico and are within relatively close proximity to the City limits. Therefore, an additional analysis was completed to determine the efficacy of the combined system to deliver a four-minute travel time or less to 90% of the incidents. Results found that the county's three fire stations (41, 42, and 44) contributed an additional 12.16% but fell short of the 90th percentile at 74.33%. Station 42 is best positioned to provide improvement and accounted for 11.11% of the 12.16% improvement. Results are provided below as Table 3 and Figure 2.

Table 3: Marginal Fire Station Contribution Chico and County Stations with 4-Minute Travel Time

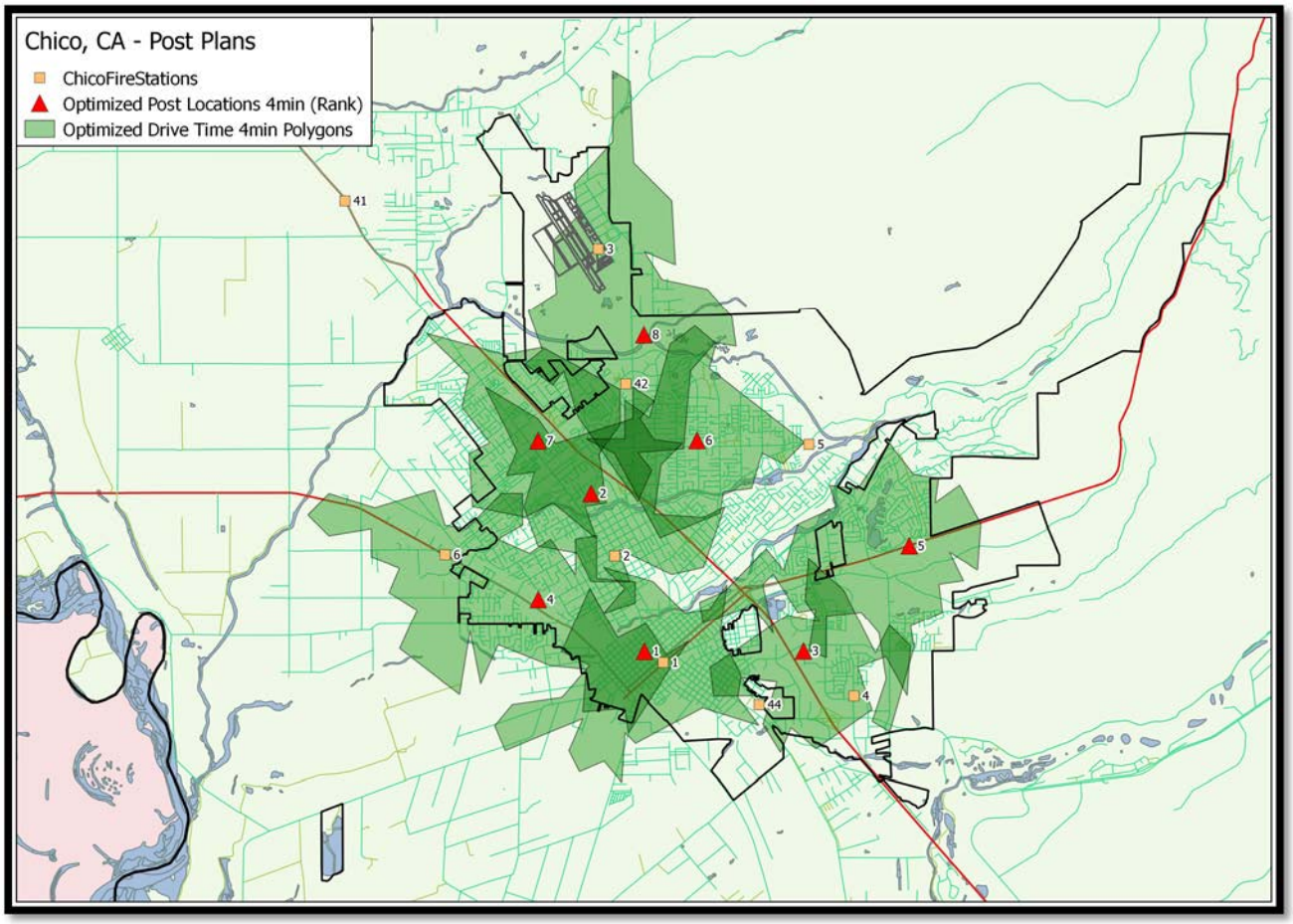
Rank	Station Number	Station Capture	Total Capture	Percent Capture
1	1	3512	3512	29.09%
2	2	2113	5625	46.59%
3	42	1341	6966	57.70%
4	6	726	7692	63.71%
5	4	610	8302	68.77%
6	5	545	8847	73.28%
7	44	95	8942	74.07%
8	41	32	8974	74.33%

Figure 2: 4-Minute Travel Time Bleed with Chico and County Fire Stations (excluding Station 3)



Finally, because all stations included could not achieve the desired 90th percentile for a four-minute travel time, an optimized station deployment model was created to determine what the fire station distribution model would require. Results suggest that an optimally placed eight fire station configuration would achieve a four-minute travel time to 90% of the incidents. A graphic illustration of the optimized model is provided below:

Figure 3: Optimized Station Deployment Plan with 4-Minute Travel Time Bleed



EVALUATION OF VARIOUS DISTRIBUTION MODELS

As previously discussed, these analyses will utilize the current historical fire performance as the upper threshold for system designs. Therefore, the travel time for Fire related incidents at six minutes was utilized for the various system configurations.

Validation of Planning Analysis

The first step in this analysis is to utilize the historical performance to validate the planning analyses utilized by the GIS system. The historical performance demonstrated a 6.0 travel time capability from the existing fire stations (including Station 3) at the 90th percentile and the planning assessment estimated 89.12%. Therefore, there is more than 99% agreement between the planning tools and the actual historical performance.

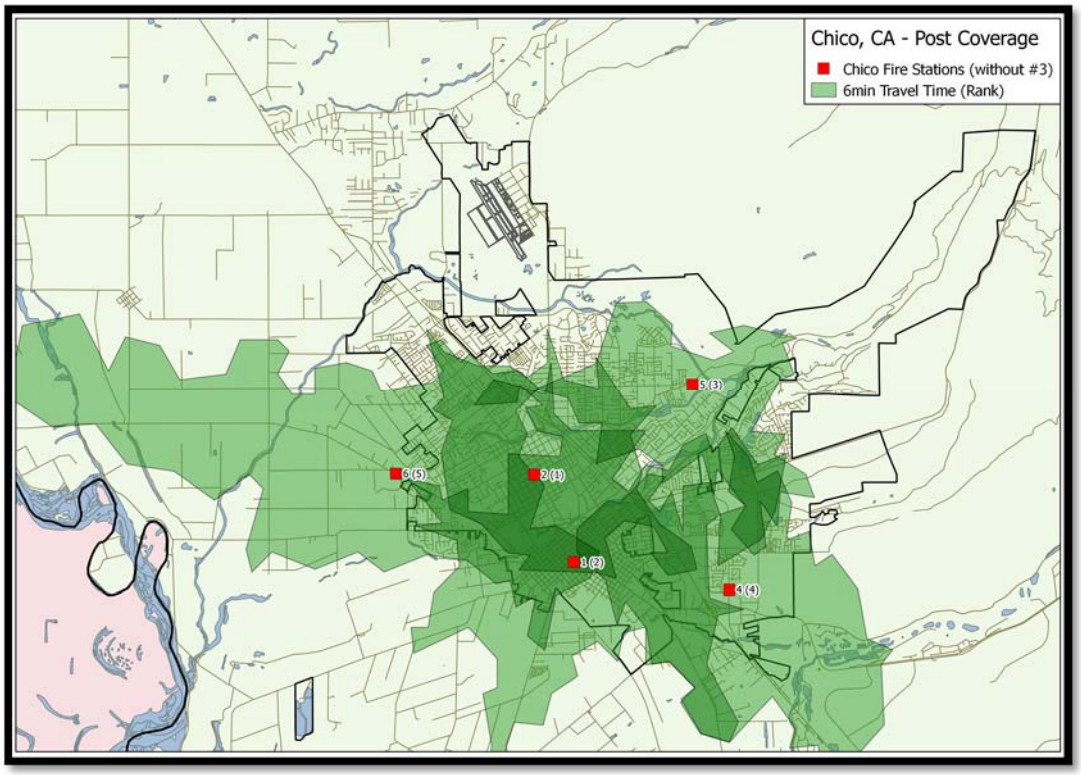
Configuration Models based on 6-Minute or less Travel Time

Results suggest that if the Department is desirous of maintaining current performance that it will require a five fire station configuration in order to most closely approximate a 6-minute travel time to 90% of the incidents. Station 2 was able to contribute 58.25% of the geographic coverage and the combination of Station 1 and 2 can cover nearly 80% of the historical incidents. Results are provided as Table 4 and Figure 4 below.

Table 4: Marginal Fire Station Contribution with Chico Fire Stations for 6-Minute Travel Time

Rank	Station Number	Station Capture	Total Capture	Percent Capture
1	2	7033	7033	58.25%
2	1	2538	9571	79.28%
3	5	698	10269	85.06%
4	4	353	10622	87.98%
5	6	138	10760	89.12%

Figure 4: 6-Minute Travel Time Bleed with Chico Fire Stations (excluding Station 3)

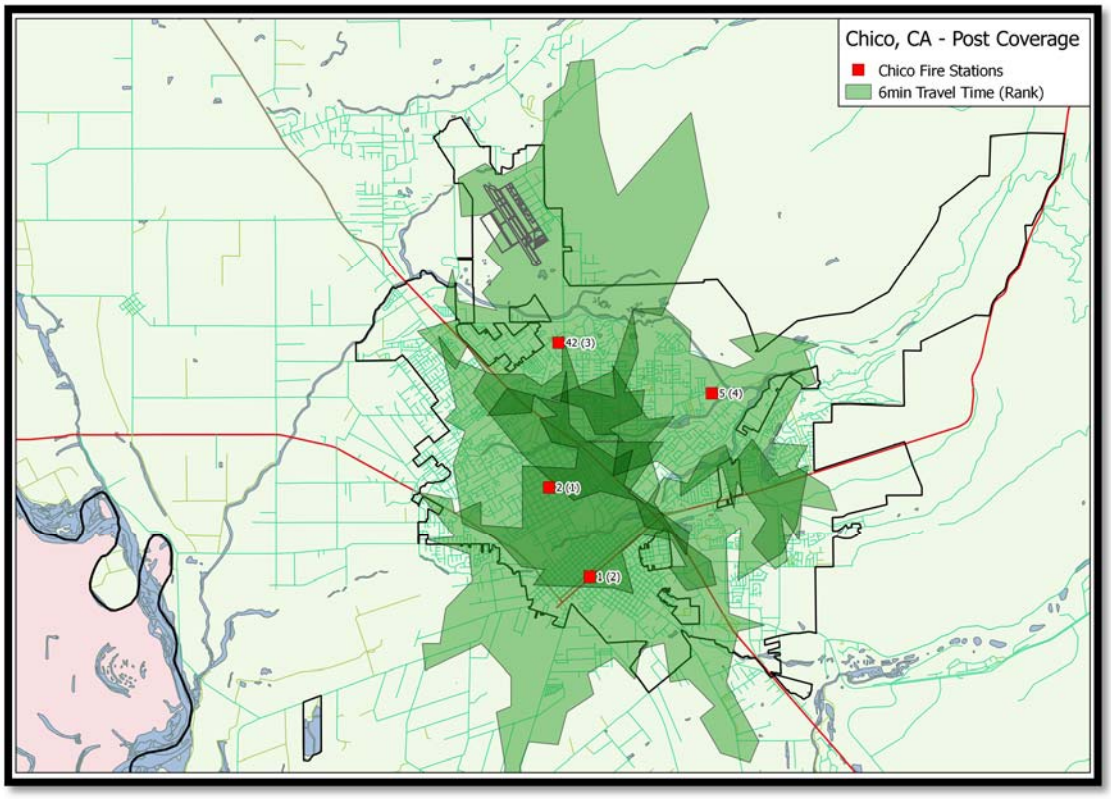


It is understood that the Butte County Fire Department (Cal Fire) provides automatic and mutual aid coverage for the City of Chico and are within relatively close proximity to the City limits. Therefore, several additional analyses were completed to determine the efficacy of the combined system to deliver a six-minute travel time or less to 90% of the incidents with the variable assumptions levied. Results found that the county's three fire stations (41, 42, and 44) contributed an additional 8.8% but the synergy between combined station locations affords a four-station distribution model to maintain the current six-minute travel time performance as well as improves overall performance by approximately 3%. Station 42 is best positioned to provide improvement and accounted for 8.32% of the 8.8% improvement. Results are provided below as Table 5 and Figure 5.

Table 5: Marginal Fire Station Contribution with Chico and County Fire Stations for 6-Minute Travel Time

Rank	Station Number	Station Capture	Total Capture	Percent Capture
1	2	7033	7033	58.25%
2	1	2538	9571	79.28%
3	42	1005	10576	87.60%
4	5	639	11215	92.89%
5	4	353	11568	95.82%
6	6	137	11705	96.95%
7	41	85	11790	97.66%
8	44	32	11822	97.92%

Figure 5: 6-Minute Travel Time Bleed with Chico and County Fire Stations (excluding Station 3)



Implications of Potential Changes in Butte County Deployment

The current configuration of automatic aid between the City of Chico and Butte County has Station 42 providing considerable first due responses within the City. While this is considered best practice when the unit is the closest resource to the incident and has commensurate capabilities, the City should understand the implications associates with changes to the County's distribution model.

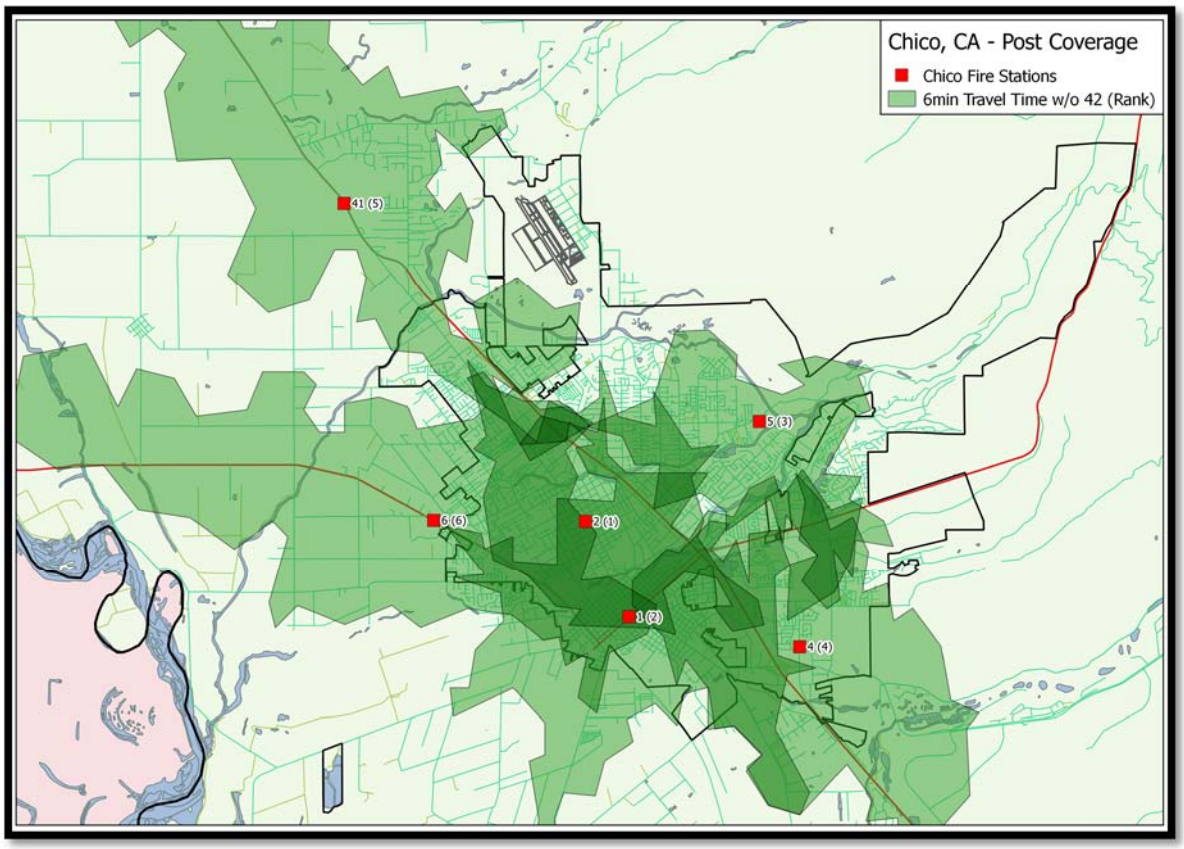
Previous analyses have suggested that Stations 41 and 44 would contribute less than 1% to Chico's overall performance and capabilities and therefore will not analyzed again here. However, both geographically and strategically, Station 42 supplements the City's performance. An analysis of the implication of Station 42 closing on the systems ability to maintain a 6-minute or less travel time performance was completed.

Results suggest that it would require a six-station distribution model to maintain the 6-minutes or less 90% of the time. However, when evaluating the relative performance adjustments, a four-station model will accomplish the desired performance approximately 88% of the time, or 2% below the current configuration. Therefore, the better system design would include either Station 42 or a Chico fire station in close proximity to Station 42's location. From a policy perspective, a similar four-station configuration without Station 42 may not be deemed unreasonable when compared to the costs associated with a 2% improvement.

Table 6: Marginal Fire Station Contribution with Chico and County Fire Stations for 6-Minute Travel Time (excluding Station 42)

Rank	Station Number	Station Capture	Total Capture	Percent Capture
1	2	7033	7033	58.25%
2	1	2538	9571	79.28%
3	5	698	10269	85.06%
4	4	353	10622	87.98%
5	41	182	10804	89.49%
6	6	138	10942	90.63%
7	44	32	10974	90.90%

Figure 6: 6-Minute Travel Time Bleed with Chico and County Fire Stations (excluding Station 42)



Potential Station Consolidations

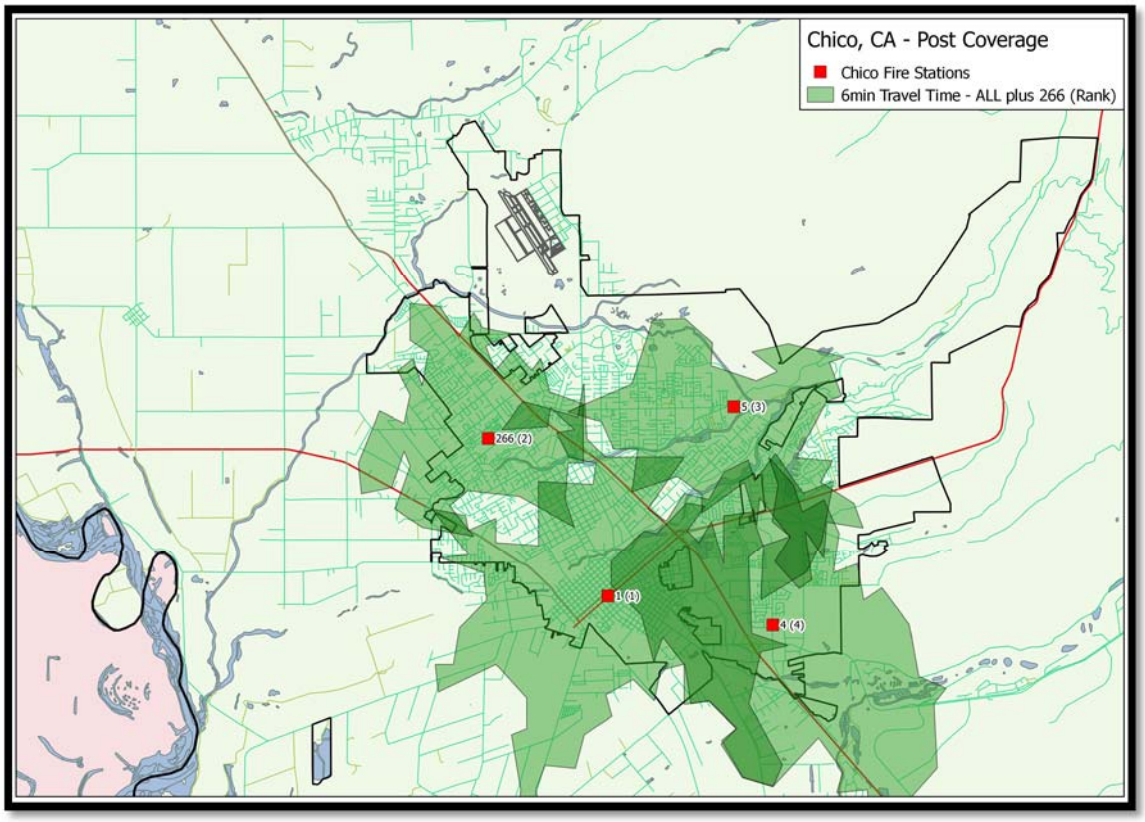
The Chico Fire Department presented *FITCH* with two distinct station consolidation efforts to evaluate the potential impact of adopting these changes. Most notably, these changes are associated with the combining of Station's 2 and 6, identified for these analyses as the new Station 266. Similarly, the potential future site of a Public Safety Facility (Police/Fire), identified for these analyses as new Station 444 was evaluated. The desired locations of these potential station consolidations, or new facilities, were provided by the Department and were incorporated into the analyses as if the stations currently existed as well as simultaneously removed Stations 2, 4, and 6.

First, the impact of creating Station 266 was evaluated. Results suggest that the remaining four-stations provided by Chico will accomplish a 6-minute travel time at 88.5%, or 1.5% less than optimal design. Similar to the previous discussion with Station 42, it would not be unrealistic for a policy group to be willing to assume the 1.5% of potential risk within the context of the additional cost to achieve the 90th percentile.

Table 7: Marginal Fire Station Contribution for Station 266 with Chico Fire Stations for 6-Minute Travel Time

Rank	Station Number	Station Capture	Total Capture	Percent Capture
1	1	6804	6804	56.36%
2	266	2512	9316	77.16%
3	5	1022	10338	85.63%
4	4	353	10691	88.55%

Figure 7: 6-Minute Travel Time Bleed with Chico Fire Stations and Creating Station 266

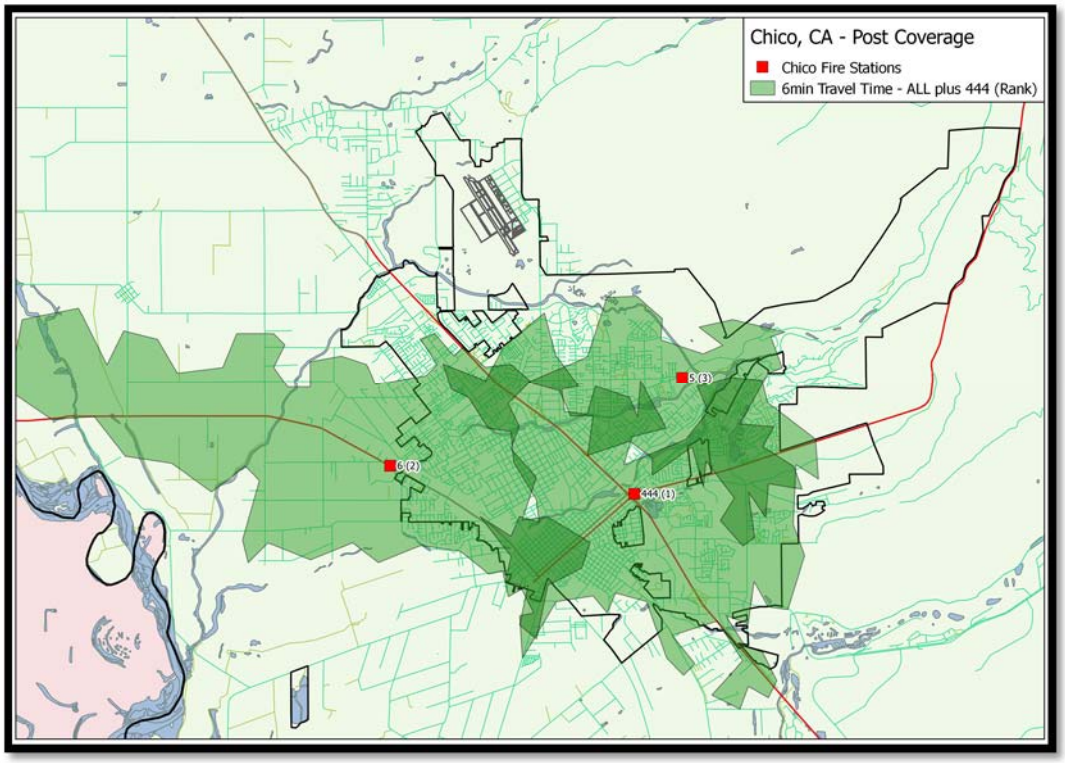


Second, the impact of creating Station 444 was evaluated. Results suggest that the creation of Station 444 would become the highest performing station in the system capturing nearly 71% of the historical incident risk within 6-minutes travel time. This configuration would afford a three-station distribution model that would achieve a six-minute travel time 92.07 of the time. This reconfiguration would only require Stations 444, 6, and 5 to achieve this level of performance. Stations 1 and 2, that historically contributed the most to the overall system performance, would only improve the system by approximately 1.5%.

Table 8: Marginal Fire Station Contribution for Station 266 with Chico Fire Stations for 6-Minute Travel Time

Rank	Station Number	Station Capture	Total Capture	Percent Capture
1	444	8531	8531	70.66%
2	6	2038	10569	87.54%
3	5	547	11116	92.07%
4	2	162	11278	93.42%
5	1	20	11298	93.58%

Figure 8: 6-Minute Travel Time Bleed with Chico Fire Stations and Creating Station 444

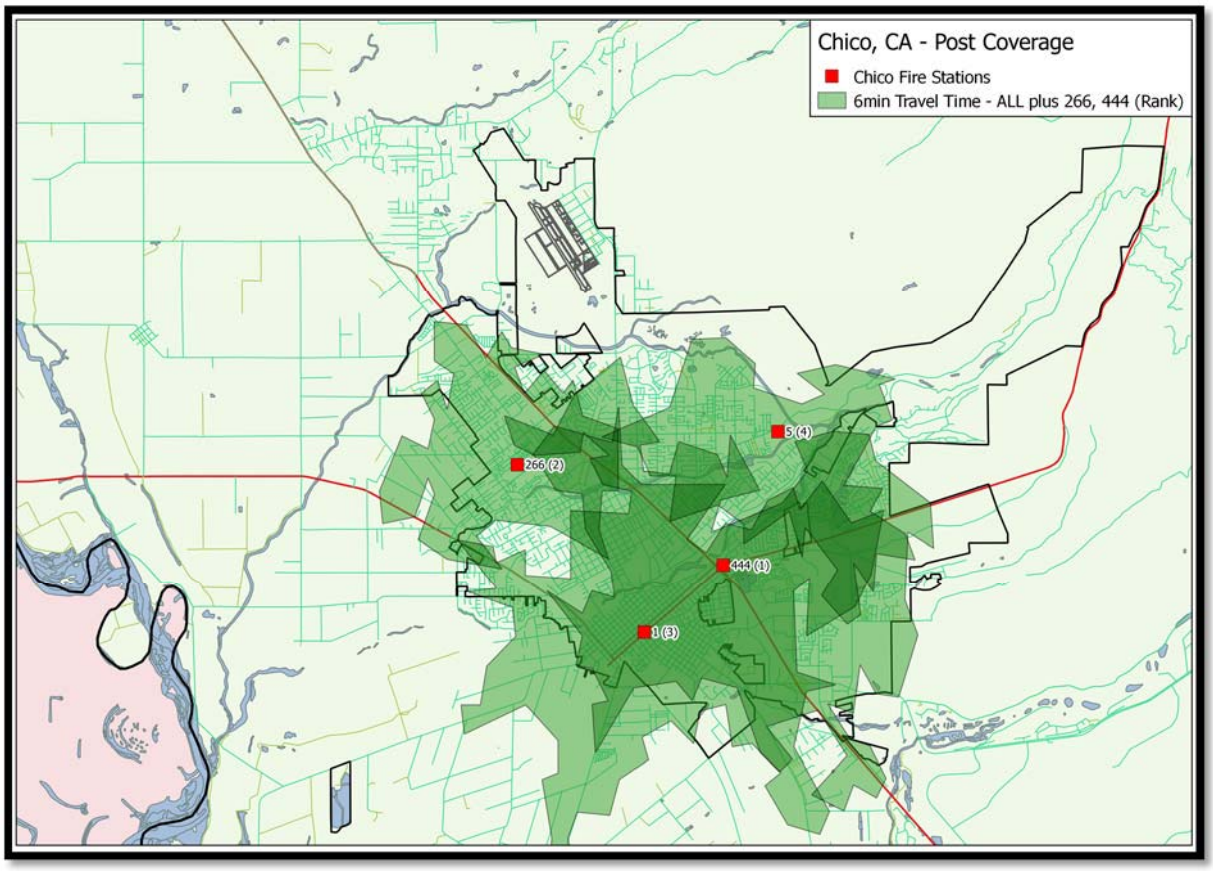


Finally, the creation of both Stations 266 and 444 were analyzed. Results demonstrate that a four-station distribution model would be required to address the historical demand for services and the geographic limitations within the system. Similar to previous discussions, the potential for a three-station model does exist at 88.88%, or nearly 89% coverage at 6-minutes travel time. However, this four-station configuration would outperform the current five-station configuration by approximately 4%. Results are presented in both tabular form and map output as Table 9 and Figure 9.

Table 9: Marginal Fire Station Contribution for Stations 266 and 444 with Chico Fire Stations for 6-Minute Travel Time

Rank	Station Number	Station Capture	Total Capture	Percent Capture
1	444	8531	8531	70.66%
2	266	1323	9854	81.62%
3	1	876	10730	88.88%
4	5	547	11277	93.41%

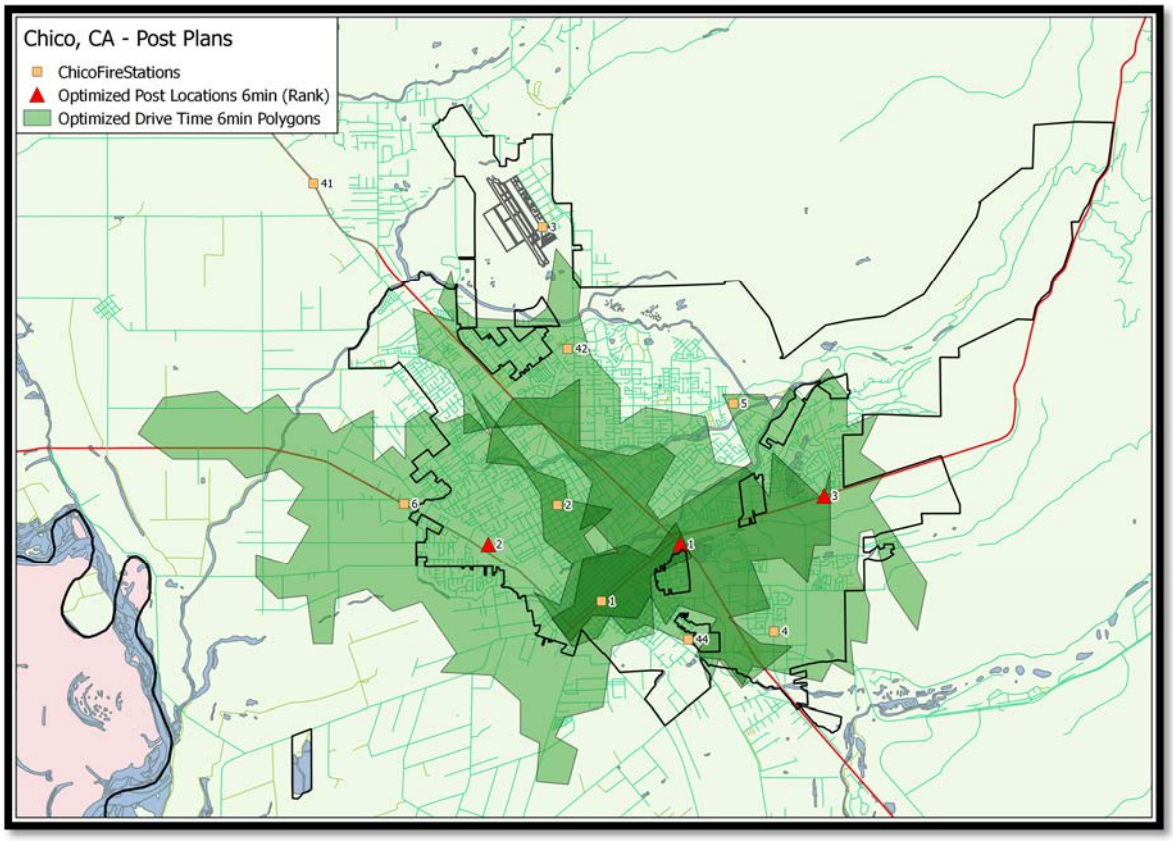
Figure 9: 6-Minute Travel Time Bleed with Chico Fire Stations and Creating Stations 266 and 444



Optimized Station Distribution Plan

An analysis was completed to develop an optimized station distribution model. This evaluation confirmed previous analyses, that an optimized three-station model can provide for greater than 90% effectiveness covering all incidents within 6-minutes or less travel time 92.04% of the time. Both the suggested station locations and the current City and County stations are located on the map for reference. It is interesting to note that the number one optimized station is nearly identically placed with the department's consolidated Station 444. A graphic illustration is presented as Figure 10 below.

Figure 10: Optimized Station Deployment Plan - 6-Minute Travel Time



Long-Term Sustainability of the Models Presented

It is important to understand that the distribution models are restrictive to the geographic limitations of the jurisdiction and the historical demand for services. Therefore, the number of stations is descriptive of the number of fixed facilities required from which to deploy resources. These analyses do not specifically describe the concentration of resources required at each fire station facility to adequately handle the demand for services. For example, some stations may require two or more units in order to handle the demand for services. The full deployment strategy will be provided within the Standards of Cover document.

With respect to the long-term sustainability of the deployment models presented here, the models will remain accurate for as long as the jurisdictions overall coverage area has not expanded. In other words, if the City remains 33 square miles, then the deployment strategy will be sustainable indefinitely with respect to the coverage area. As other variables such as population density or changes in socioeconomic status change over time, there may be a need for a higher concentration of resources necessary to meet the growing demand for services, but not additional stations. The most prominent reason that the geographic distribution model would need to be updated are for changes in traffic impedance that significantly limit the historical average travel speed. Monitoring

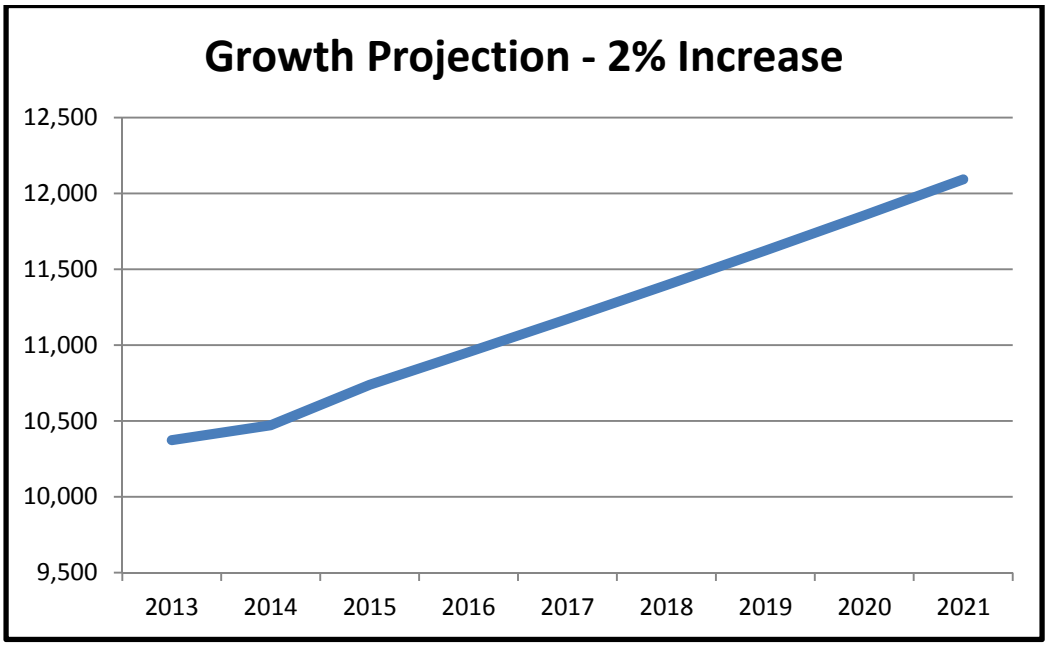
travel time performance, system reliability, and call concurrency will provide timely feedback for changes in the environment that could impact the distribution model.

Finally, while the number of calls has increased each year from 2013 through 2015, the annual time on task has fluctuated and 2015 is less than 2013. Assuming that future demands will be reasonably distributed across the various stations in the system, the system should be stable through 2021. An average growth of 2% was utilized as a constant or linear projection for future call volume. If the 2% remains over the next five years, there will be an increase of approximately 1,355 requests for service, or less than 4 per day. While the system should be evaluated continuously for performance and desired outcomes, the department should specifically re-evaluate workload and performance indicators for every 1,000-call increase to ensure system stability. Data are presented as Table 10 and Figure 11.

Table 10: Number of Calls, Number of Responses, and Total Busy Time by Year

Year	Number of Calls	Number of Responses	Average Responses per Call	Total Busy Hours	Average Busy Minutes per Response
2013	10,373	12,983	1.3	3,896	18.0
2014	10,471	12,692	1.2	3,234	15.3
2015	10,738	13,409	1.2	3,669	16.4

Figure 11: Growth Projections through 2021 with 2% Average Growth



DISTRIBUTION OF RISK ACROSS THE JURISDICTION

Distribution Of Demand By Program Areas

Heat maps were created to identify the concentration of the historic demand for services by program area. Therefore, the following mapping will present the relative concentration of service demands by fire, EMS, Hazmat, Rescue, and all calls respectively. The Blue areas have the least demand and the dark red areas have the highest concentration of demand.

When reviewing the heat maps, it is clear that the relative density of service demands is generally located in the corridor between Station 1 and Station 2, and at times toward Station 42.

Figure 12: Heat Map for Fire Related Incidents

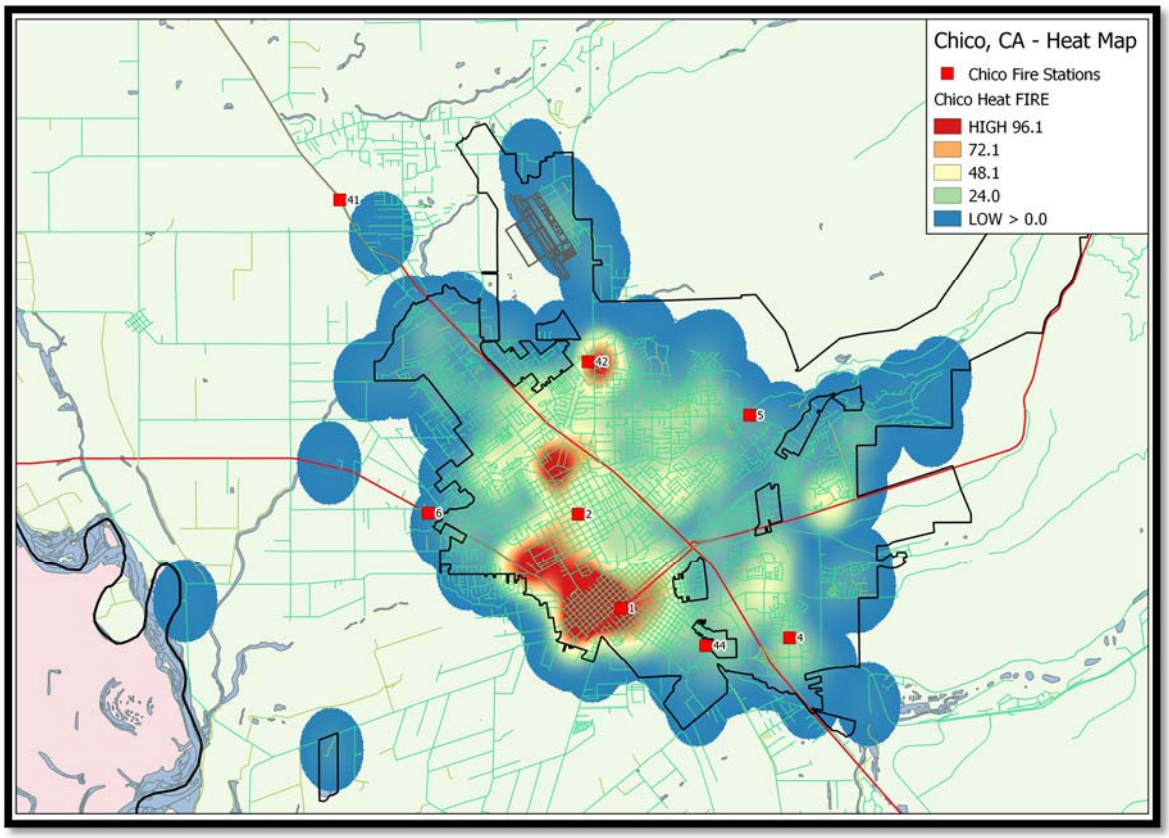


Figure 13: Heat Map for EMS Related Incidents

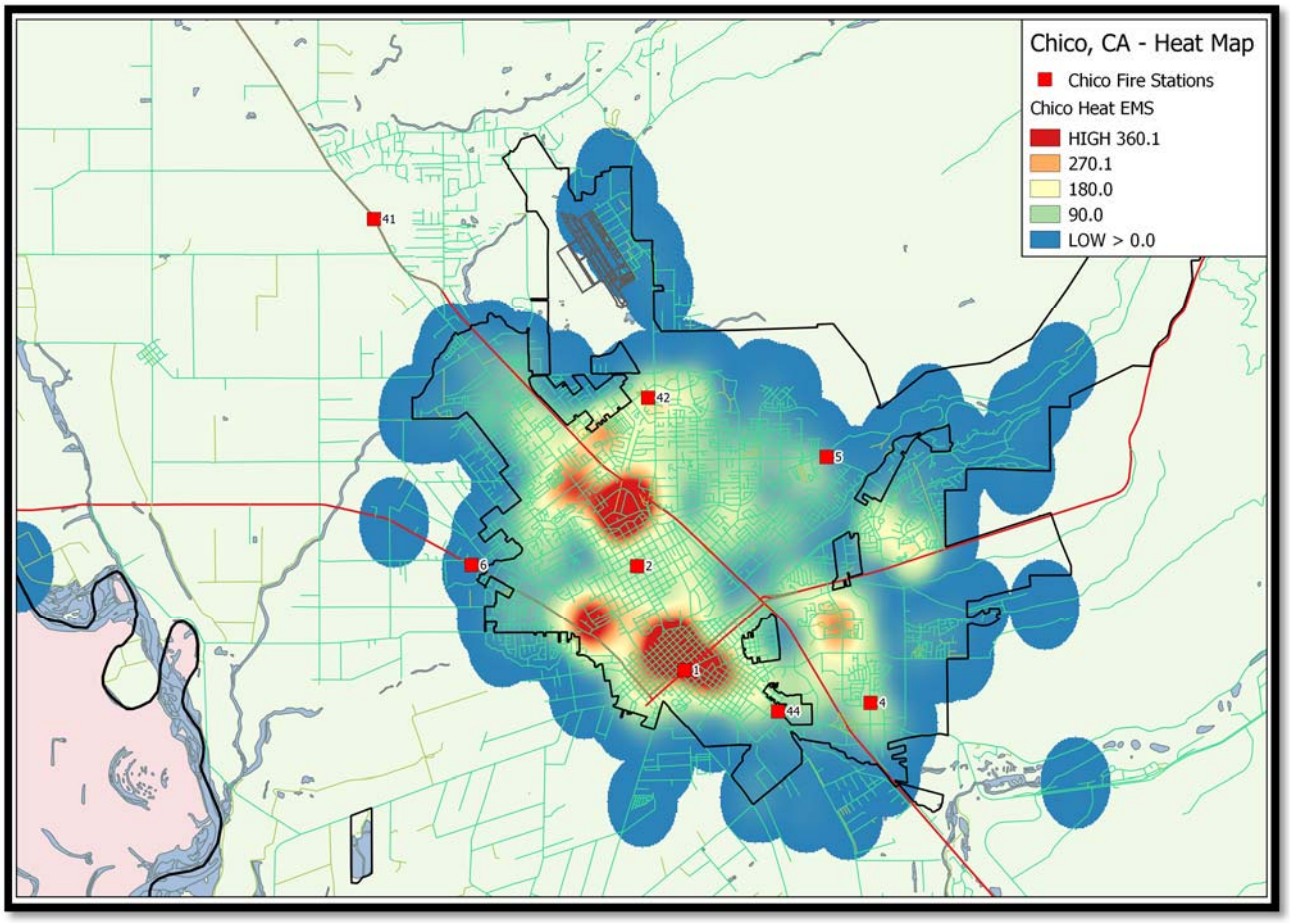


Figure 14: Heat Map for Hazardous Materials Incidents

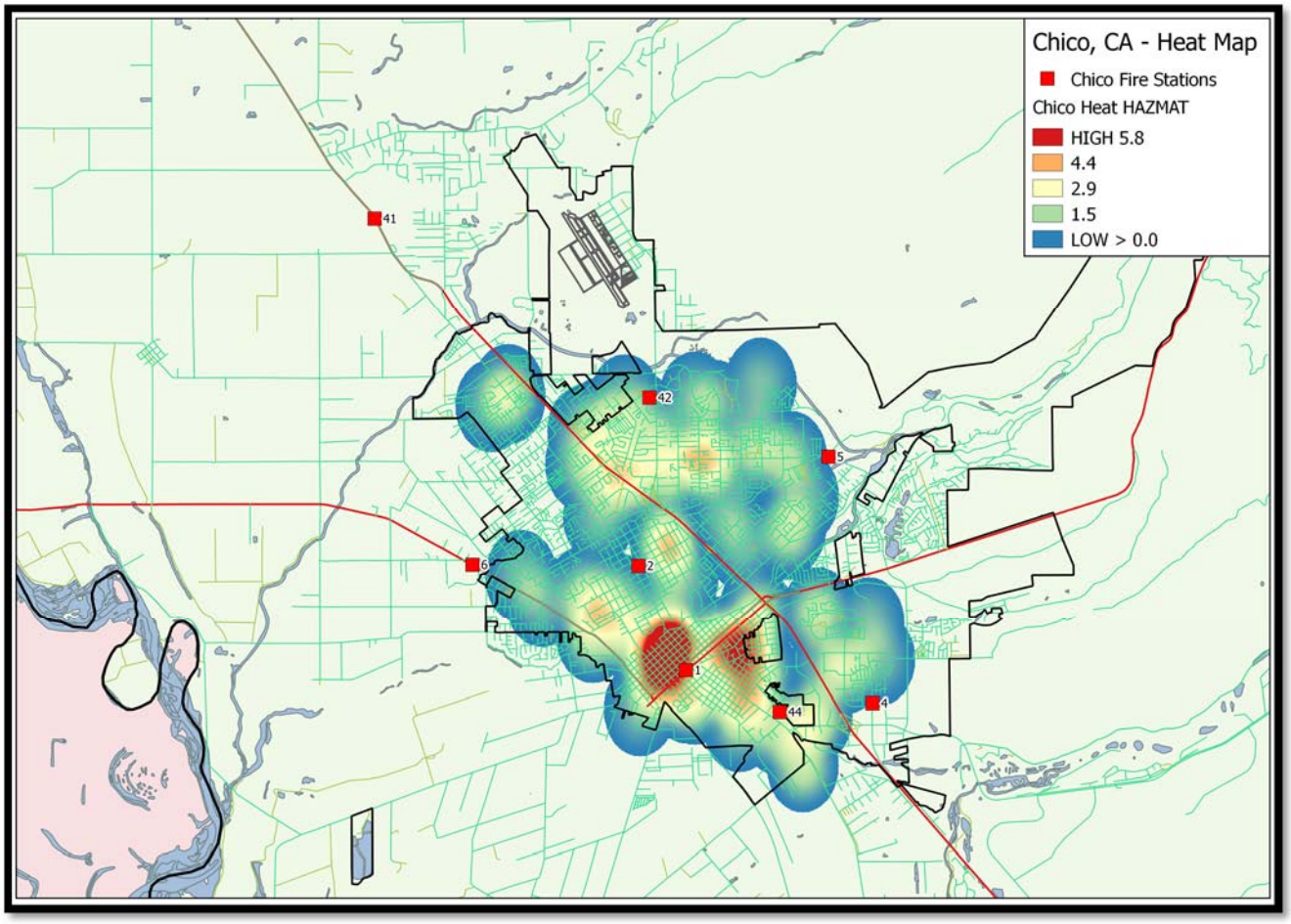


Figure 15: Heat Map for Rescue Related Incidents

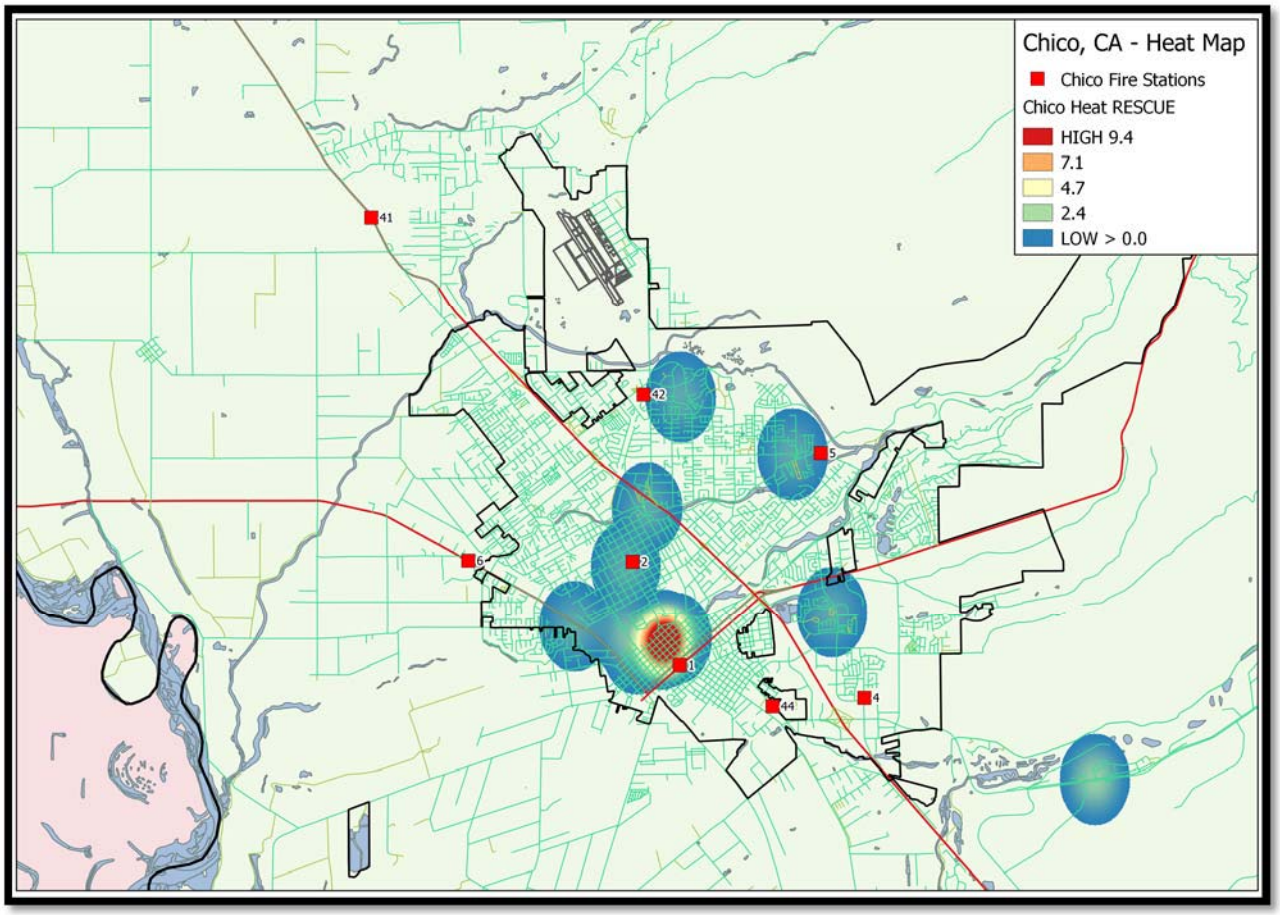
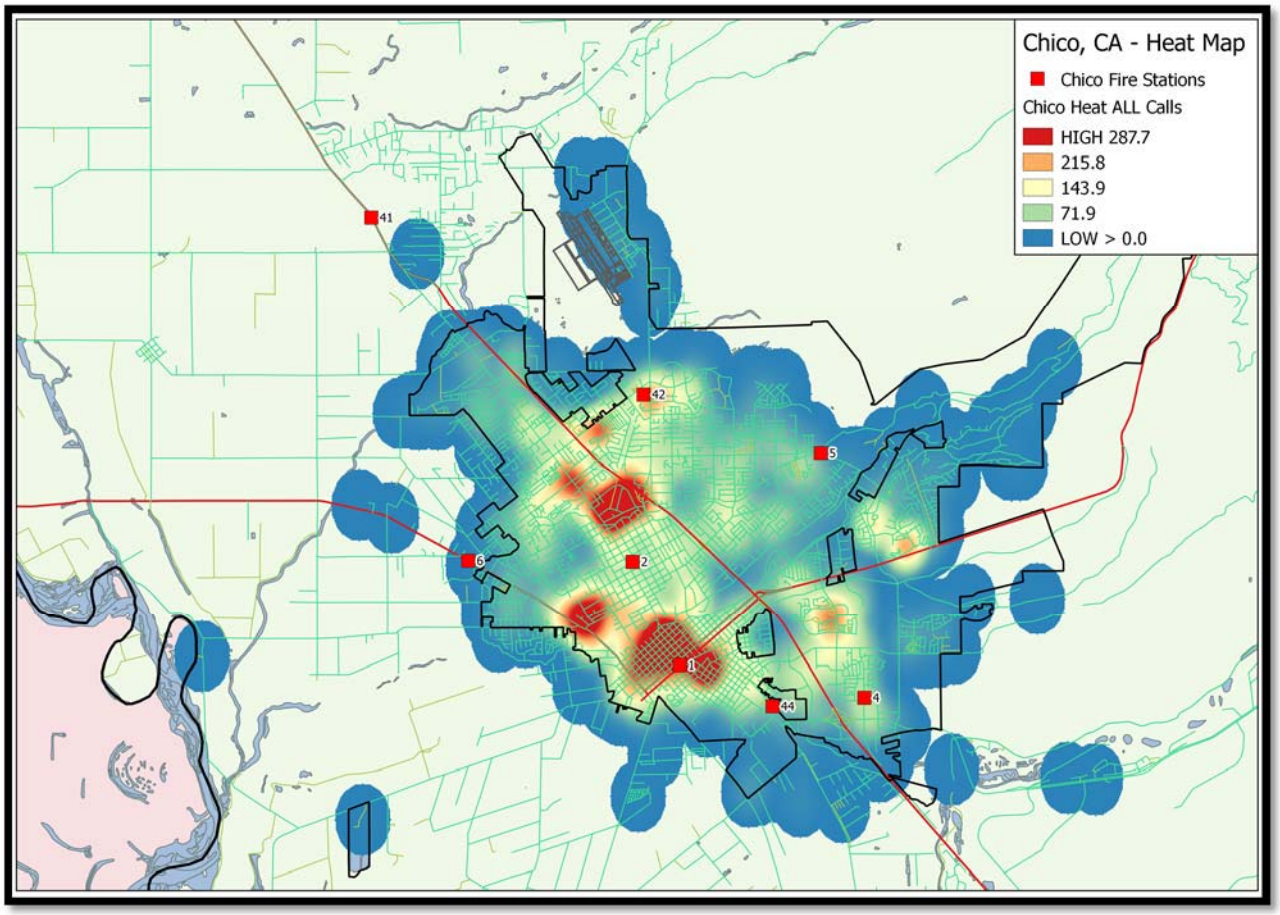


Figure 16: Heat Map for All Service Demands



Distribution Of Occupancy Risk

Occupancy risk was evaluated across the jurisdiction utilizing the most recent ISO batch report as well as internal data from provided by the department for risks associated with the California State University at Chico (CSUC). Over 1,300 occupancies were analyzed and rated as high, moderate, or low risk. In total, there were 70 occupancies rated as high risk, 831 as moderate, and 400 rated as low risk.

The risk matrices utilized and developed with the Chico fire staff is presented here as well as in the Standards of Cover document. The risk matrix utilized with the ISO data evaluated Fire Flow, Height, Square Footage, the presence of a basement, and the presence of a sprinkler system, construction class, and building combustion class. The college data was not as robust but was appropriately evaluated utilizing height, square footage, the presence of a sprinkler system, and the construction class. The risk matrices are provided as Tables 11 and 12, respectively.

Table 11: Occupancy Level Risk Matrix - ISO Data

Risk Class	Fire Flow		Number of Stories		Square Footage		Basement Present (Yes/No)	Full Credit Sprinkler System (Yes/No)	Construction Class		Building Combustion Class		Total Risk Score
	Value	Scale	Value	Scale	Value	Scale			Value	Scale	Value	Scale	Scale
High	3	≥ 1500 gpm	5	≥ 4	5	>=100k GPM	5/0	-10/0	5	Combustible or Frame	5	Quick Free and Rapid Burning	≥ 18
Moderate	2	> 499 and < 1500 gpm	3	> 1 and < 4	3	> 10k gpm < 100k GPM	5/0	-10/0	3	Joisted Masonry	3	Combustible	>8 and <18
Low	1	≤ 499 gpm	1	1	1	< 10k GPM	5/0	-10/0	1	Non-Combustible, Masonry Non-Combustible, Fire Resistive	1	Slow Non/Limited Combustible	≤ 8

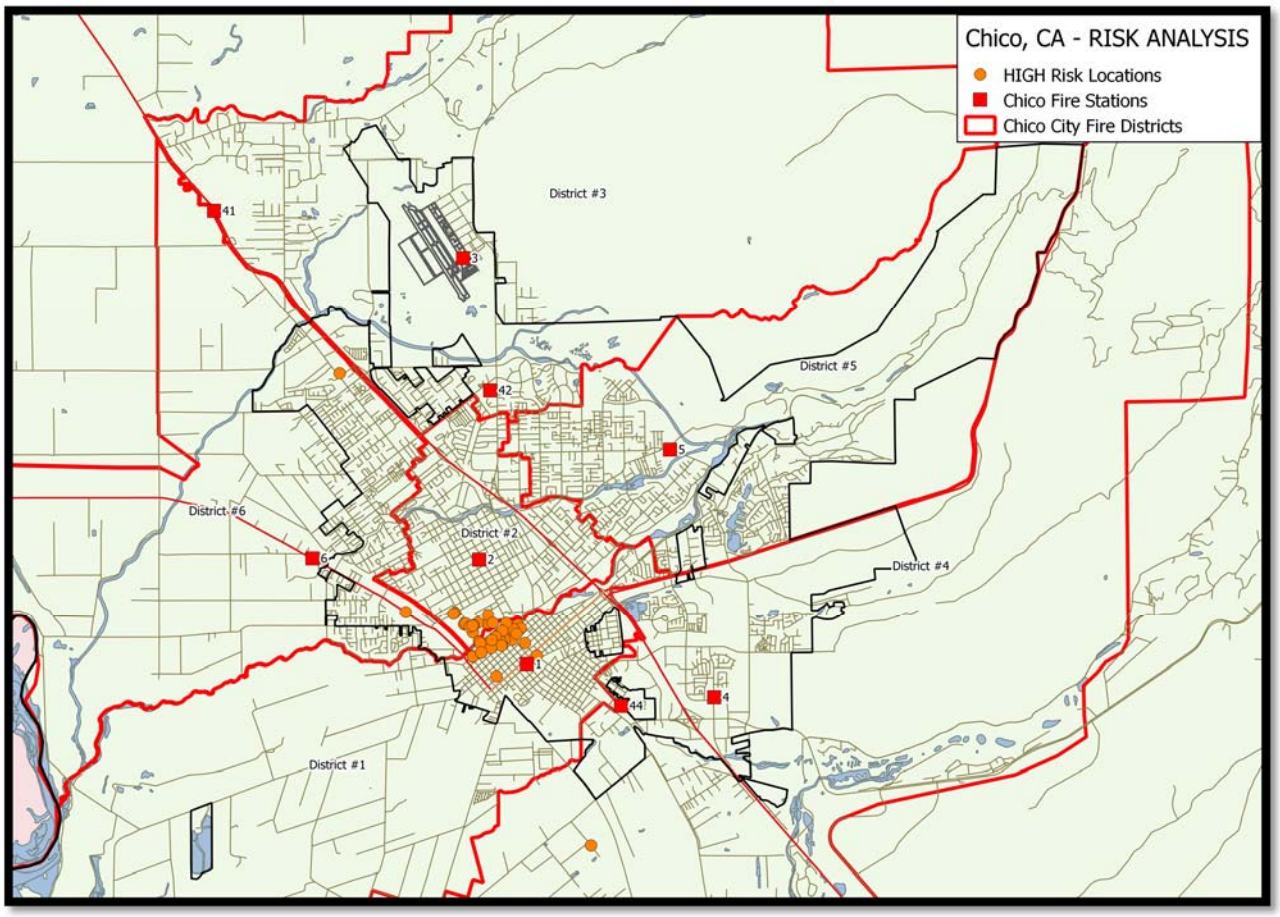
Table 12: Occupancy Level Risk Matrix - CSUC

Risk Class	Number of Stories		Square Footage		Full Credit Sprinkler System (Yes/No)	Construction Class		Total Risk Score
	Value	Scale	Value	Scale	Value	Value	Scale	Scale
High	5	≥ 4	5	>=100k GPM	-5/0	5	Combustible or Frame	≥ 10
Moderate	3	> 1 and < 4	3	> 10k gpm < 100k GPM	-5/0	3	Joisted Masonry	>3 and <10
Low	1	1	1	< 10k GPM	-5/0	1	Non-Combustible, Masonry Non-Combustible, Fire Resistive	≤ 3

Results of the occupancy risk assessment process are then mapped according to fire station demand zone. The following figures are presented in High, Moderate, and Low risks, respectively.

When reviewing the output for high-risk occupancies, it is clear that the prospective risk is concentrated between Station 1 and Station 2 following a similar pattern as the historical demand for services previously presented. From a broad perspective, this provides validation to the risk assessment process developed with the Department as well as the necessary deployment strategy to cover the historical demand for services.

Figure 17: High Risk Occupancies by Station Demand Zone



Moderate and low risk occupancies are more evenly distributed across the community and are more easily handled by the typical mitigation strategies and resource allocation while the high risk occupancies require a higher concentration of personnel.

Figure 18: Moderate Risk Occupancies by Station Demand Zone

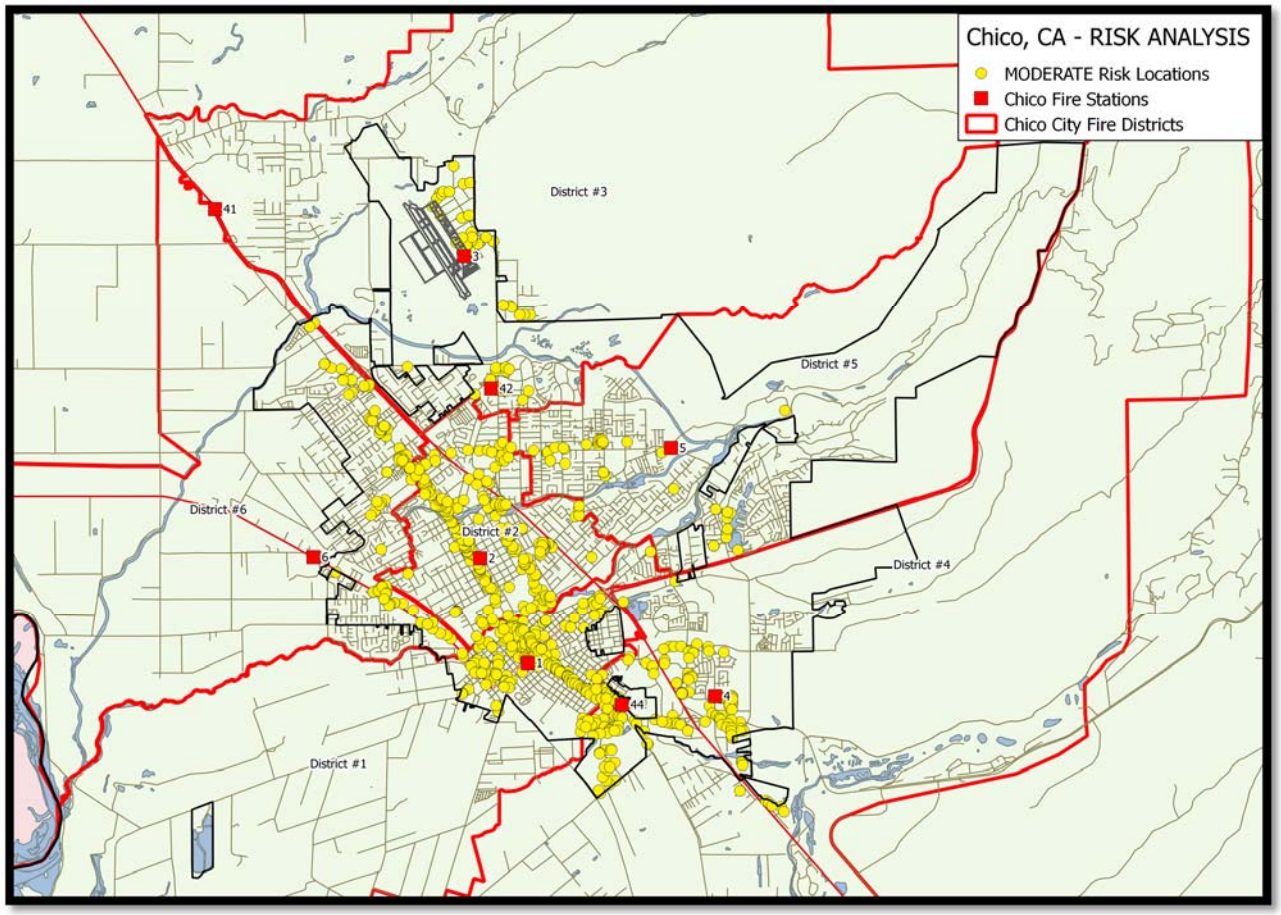
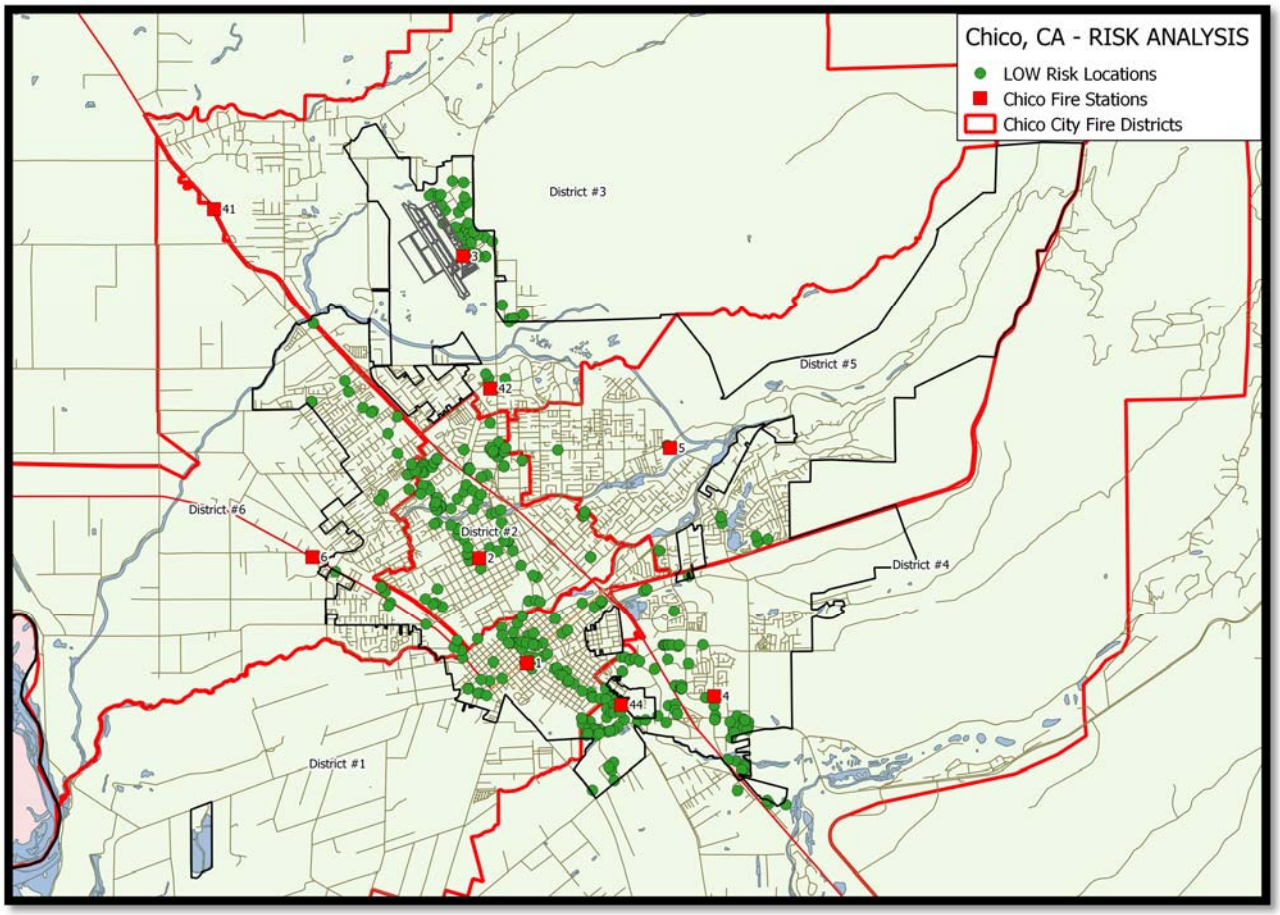


Figure 19: Low Risk Occupancies by Station Demand Zone



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